Volume XV.

DECEMBER 4, 1886, TO MAY 28, 1887.

The Sanitary Engineer

AND

Construction Record.

PUBLICATION OFFICES:

Nos. 82 & 84 Fulton Street, New York.

LONDON OFFICES, 92 and 93 FLEET ST.

FOURTEENTH VOLUME,

The Sanitary Engineer & Construction Record,

Comprising the twenty-six weekly issues from June 3 to November 27, 1886.

This large and handsome volume is an encyclopædia of all matters coming within the special scope of this periodical as a weekly journal of engineering and architecture. Aside from its weekly record of current events, it contains a vast amount of valuable technical matter specially prepared for its columns by acknowledged experts, of permanent value.

Among the more notable articles may be mentioned the following in the several departments:

ENGINEERING.

Underground Railways in Cities. Illustrated. (Continuation of the series.) The New Croton Aqueduct for New York. Illustrated. (Continued.) A very full abstract of the correspondence touching the controversy over the chief engineership of the Liverpool, Eng., Water-Works.

Pavements and Street Railroads. A fully illustrated and specially prepared series of articles.

A continuation of the illustrated series of description of American water-works, entitled "Recent Water-Works Construction."

An illustrated description of the tunnel under the River Mersey at Liverpool, Eng.

A full description of the engineering details of building the pedestal and erecting the famous Bartholdi Statue of Liberty in New York Harbor.

An illustrated description of the bursting of the Gravesend Water Tower.

"Builders' and Contractors' Engineering and Plant." The first chapters of an important series of articles by Francis Collingwood, C. E., Mem. Inst. C. E., and Mem. Am. Soc. C. E. In addition to the foregoing there are numerous articles of interest to civil, mechanical and sanitary engineers.

ARCHITECTURE.

Cottage (Small) Hospital Construction, by Henry C. Burdett. Illustrated. (The series continued.)

Fire-Proof Construction, by Francis Collingwood, Mem. Am. Soc. C. E., Mem. Inst. C.E. Illustrated. (The series continued.)

A specially prepared article by Capt. W. H. Bixby, Corps of Engineers, U. S. A., entitled "Suggestions to Govern the Erection of Buildings, based on the Experiences of the Charleston Earthquake."

In addition to the architectural matter outlined above there are besides 26 large sheet pictures and 29 vignette illustrations of moderate low-cost houses, all of which have been selected for publication (under the advice of experts) as possessing some notable architectural merit.

LIST OF BUILDINGS.

Country Seat near Philadelphia, G. W. & W. D. Hewitt, architects.

Country Seat near Philadelphia, Addison Hutton, architect.

Cathedral, Toledo, Spain.

Residence of John F. Mason, Newport, R. I., Clarence S. Luce, architect.

Residence of W. T. Tiers, Bryn-Mawr, Pa., Hartwell & Richardson, architects.

Second Presbyterian Church, Chicago, Ill., John Addison, architect

First Congregational Church, St. Louis, Mo., Hurd & Rice, architects.

An old house at Lisieux, Normandy.

Stations on the Philadelphia, Germantown and Chestnut Hill R.R., W. Bleddyn Powell, architect

Club house, Tuxedo Park, N. Y., Bruce Price architect.

Church of the Redeemer, Bryn-Mawr, Pa., Chas. M. Burns, Jr., architect.

The Astor building, N. Y., H. J. Hardenburg, architect.

Court of the Great Mosque at Damascus.

Residence of Dr. Bainbridge Folwell, Buffalo, N. Y., Silsbee & Martin, architects.

Residence of James Adams, Buffalo, N. Y., Green & Wicks, architects.

Residence of Arthur P. Emmons, Newport, R. I., Peabody & Stearns, architects

Residence of Dr. George A. Bronson, St. Louis, Mo., Peabody & Stearns, architects.

Residence of Judge H. Brown, Detroit, Mich., W. H. Miller, architect.

Residence of F. Torrey, Dorchester, Mass., Cabot & Chandler, architects.

St. James' Episcopal Church, N. Y., R. H. Robertson, architect.

Architecture in the Adriondacks, four views.

Residence of Lloyd Phœnix, N. Y., McKim, Mead & White, architects.

Batchelor apartment house, Washington, D. C., Hornblower & Marshall, architects.

Frognal Priory, England (interior), R. Norman Shaw, architect.

Union Theological Seminary, New York City, William A. Potter, architect.

Stations on the Boston, Albany and Connecticut River R. R., H. H. Richardson, architect.

Bartholdi Statue, New York Harbor.

Residence of H. M. Knisely, Chicago, Ill., Burnham & Root, architects.

Residence of Dr. F. C. Shattuck, Boston, Mass., Cabot & Chandler, architects.

Residence of H. S. Leach, Saratoga Springs, N. Y., S. Gifford Slocum, architect.

Lehigh University gymnasium, Bethlehem, Pa., Addison Hutton, architect.

St. Bartholemew's Church, Irvington, N. Y., Renwick & Sands, architects.

SANITATION.

Municipal and Domestic Sanitation has been discussed in a careful rather than a sensational manner, and in addition to the usual editorial discussions are the reviews of official reports, etc. A notable article is a detailed illustrated description of the methods adopted to provide temporary relief for the small-pox sufferers during the terrible epidemic in Montreal in 1885.

DOMESTIC ENGINEERING.

English Plumbing Practice (continuation of the series). Steam-Fitting and Steam-Heating (continuation of the series). Illustrated descriptions of water and heating service of notable buildings, including Potter Building, New York, U. S. Treasury building, Washington D. C. (plumbing), Dudley Street Grammar School, Boston (heating and ventilation).

There are also illustrated replies to many interesting problems met with in every-day practice, submitted by practical men. Numerous illustrated descriptions of both new and old appliances for plumbing and heating.

CONTRACTING INTELLIGENCE.

Under this heading will be found a weekly record of the news of current and projected building and engineering works—Advertisements for proposals—Abstracts of bids opened, etc., the whole making the volume of great value to those interested in this department, as a record of prices and materials.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD

DEVOTED TO SANITATION ENGINEERING ARCHITECTURE CONSTRUCTION

A JOURNAL for the ARCHITECT ENGINEER MECHANIC and MUNICIPAL OFFICER

CONDUCTED BY HENRY C. MEYER.

INDEX TO VOLUME XV.

DECEMBER 4, 1886, TO MAY 28, 1887.

82 & 84 Fulton Street, New York.

London Office, 92 & 93 Fleet Street.

When a date occurs the reference is to the supplement of that week; the number following the date is the page number of the supplement.

SPECIAL ILLUSTRATIONS.

VIGNETTE ILLUSTRATIONS.

ILLUSTRATIONS OF HOUSES OF MODERATE COST.

SCALE DRAWINGS AND DETAILS.

A

B

CONTRACTING INTELLIGENCE.

We here give an index of the more important items in our Construction Notes and Contracting Intelligence.

WATER-WASTE PREVENTION: Its importance and the evils due to its neglect. By HENRY C. MEYER, editor of THE SANITARY ENGINEER and CONSTRUCTION RECORD.

EXTRACT FROM PREFACE.

DURING the summer of 1882 the Editor of THE SANITARY ENGINEER AND CONSTRUCTION RECORD carefully investigated the methods employed in various cities in Great Britain for curtailing the waste of water without subjecting the respective communities to either inconvenience or a limited allowance. The results of this investigation appeared in a series of articles entitled "New York's Water-Supply," the purpose being to present to the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD such facts as would stimulate public sentiment in support of the enforcement of measures tending to prevent the excessive waste of water so prevalent in American cities, and especially the city of New York, which was then suffering from a short supply. Numerous requests for information, together with the recent popular agitation in connection with a proposition to increase the powers of the Water Department of New York City with a view to enabling it to restrict the waste of water, have suggested the desirability of reprinting these articles in a more convenient and accessible form, with data giving the results of efforts in this direction in American cities since the articles first appeared, so far as they have come to the author's notice.

PRESS COMMENTS.

"No patented appliances are recommended, but such simple means as are free to all. We recommend the careful reading of this little book to every resident of a city who is interested in its water-supply, and particularly to those who, by virtue of vested authority, have to some extent the matter of water-waste prevention in their hands."—*American Machinist.*

"The author of this timely book is particularly adapted to deal with the questions he discusses. But few have given the subject so much attention, and no one could treat it more impartially. He is not only intimately acquainted with the water-supply of American cities, but has personally investigated the plans adopted for curtailing water-waste in various cities in Great Britain, the results of these investigations appearing in this work.

"As our cities increase in population, and new cities spring up, the demand for more water correspondingly increases. At the same time the water-supply is diminishing, and that which would otherwise be available is rendered unfit for use by the contamination of sewage and the refuse of manufactories. It is conceded that the inhabitants of a city should be supplied with all the water they can use. It is not with the *use*, but with the *waste* of water that the author deals.—*American Machinist.*

"It is worthy of close attention. Mr. Meyer discloses the true spirit of the disinterested investigator."—*Hartford Evening Post.*

"It does not fall into the mistake of recommending a special system for all places." * * —*Montreal Star.*

"* * * An interesting and valuable volume on public water-supply, and particularly the prevention of waste."—*Atlanta Constitution.*

"One of the best and most useful publications now before the public. * * * A copy of this timely publication ought to be in the hands of all water company and city officials and plumbers, and even water consumers might read it with profit."—*Memphis Appeal*

Price, $1.00. Sent post paid on receipt of price.

Address *BOOK DEPARTMENT,*

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

P. O. Box 3037. 82 & 84 Fulton Street, New York.

Obtainable at London Office, 92 and 93 Fleet St., for 5s

THE PRINCIPLES OF VENTILATION AND HEATING AND THEIR PRACTICAL APPLICATION. By JOHN S. BILLINGS, M.D., LL.D.(Edinb.), Surgeon U. S. Army. Profusely illustrated.

SECOND EDITION.

(With Corrections, November, 1886.)

Expense of Ventilation—Difference Between "Perfect" and Ordinary Ventilation—Relations of Carbonic Acid to the Subject—Methods of Testing Ventilation.

Heat, and some of the Laws which Govern its Production and Communication—Movements of Heated Air—Movements of Air in Flues—Shapes and Sizes of Flues and Chimneys.

Amount of Air-Supply Required—Cubic Space.

Methods of Heating: Stoves, Furnaces, Fire-Places, Steam, and Hot Water.

Scheduling for Ventilation Plans—Position of Flues and Registers—Means of Removing Dust—Moisture, and Plans for Supplying It.

Patent Systems of Ventilation and Heating—The Ruttan System—Fire-Places—Stoves.

Chimney-Caps—Ventilators—Cowls—Syphons—Forms of Inlets.

Ventilation of Halls of Audience—Fifth Avenue Presbyterian Church—The Houses of Parliament—The Hall of the House of Representatives.

Theatres—The Grand Opera-House at Vienna—The Opera-House at Frankfort-on-the-Main—The Metropolitan Opera-House New York—The Madison Square Theatre, New York—The Criterion Theatre, London—The Academy of Music, Baltimore.

Schools.

Ventilation of Hospitals—St. Petersburgh Hospital—Hospitals for Contagious Diseases—The Barnes Hospital—The New York Hospital—The Johns Hopkins Hospital.

Forced Ventilation—Aspirating-Shafts—Gas-Jets—Steam Heat for Aspiration—Prof. Trowbridge's Formulæ—Application in the Library Building of Columbia College—Ventilating-Fans—Mixing-Valves.

PRESS COMMENTS.

The *Medical News* says of "Ventilation and Heating," by John S. Billings:

"This is a book which should be read by every one who is desirous of gaining the best information in regard to methods of mitigating the injurious effects of winter's cold and summer's heat upon human organisms. In it are furnished the results of a wide experience in grappling with these great sanitary problems, and the knowledge of questions involved which caused its author to be sought for as professional consultant in the construction of the Johns Hopkins Hospital, of Baltimore, is here displayed, matured and perfected by earnest study in England and on the continent as well as in our own country. At the same time Dr. Billings does not disdain to season his severely scientific counsels with an occasional spice of the true Attic salt in such a way as to render even the dryness of heating and the vacuity of ventilation attractive to a general reader.

"Among the systems described in detail are those of the New York Hospital, and Metropolitan Opera House; the Capitol at Washington; the Houses of Parliament and the charming little Criterion Theatre in London; the St. Petersburg Hospital, and several other important structures."

"Its careful perusal would be a profitable exercise for school committees, theatre proprietors, architects, doctors, people about to build dwellings, and owners of houses already built. —*Springfield Republican.*

Large 8vo. Handsomely Bound in Cloth. Price $3.00. Postage paid.

Address BOOK DEPARTMENT,

The Sanitary Engineer & Construction Record

82 & 84 Fulton Street, New York.

Obtainable at London Office, 92 & 93 Fleet St., for 15s.

STEAM-HEATING PROBLEMS; or, Questions, Answers, and Descriptions relating to Steam-Heating and Steam-Fitting, from THE SANITARY ENGINEER AND CONSTRUCTION RECORD. With 109 illustrations.

PREFACE.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, while devoted to Engineering, Architecture, Construction, and Sanitation, has always made a special feature of its departments of Steam and Hot-Water Heating, in which a great variety of questions have been answered and descriptions of the work in various buildings have been given. The favor with which a recent publication from this office, entitled "Plumbing and House-Drainage Problems," has been received suggested the publication of "STEAM-HEATING PROBLEMS," which, though dealing with another branch of industry, is similar in character. It consists of a selection from the pages of THE SANITARY ENGINEER AND CONSTRUCTION RECORD of questions and answers, besides comments on various problems met with in the designing and construction of steam heating apparatus, and descriptions of steam-heating work in notable buildings.

It is hoped that this book will prove useful to those who design, construct, and have the charge of steam-heating apparatus.

PRESS COMMENTS.

"Full of little practical kinks, any one of which would be worth more than the price of the book to any one."—*Boston Journal of Commerce.*

"This is a most practical and useful work for the engineer and mechanic in the lines of work which it covers. * * * It contains information that every man who builds a house and contemplates heating it by modern methods should know. The contents of the book embrace papers on steam boilers, the value of heating surfaces, radiators, and heaters, piping and fitting, ventilation, steam, cutting nipples and bending pipes, raising water automatically, moisture on walls, etc., and a number of miscellaneous topics and questions, all of great interest. Clearly and ably printed."—*Boston Herald.*

"It would be difficult to find in any language a work more comprehensive than this, which will be found to answer almost every question concerning steam-heating that might occur to the non-professional or professional. —*Memphis Appeal*

"Useful to those who design, construct, and have the charge of steam-heating apparatus."—*Inland Architect.*

"* * * A book of especial importance to builders and to owners of fine buildings. The work is trustworthy, scientific, and intelligent on the latest ideas and inventions."—*Cincinnati Commercial Gazette.*

"THE SANITARY ENGINEER, the New York weekly journal devoted to engineering, architecture, construction, and sanitation, has embodied some of its valuable work in a volume of about 250 pages which treats of 'Steam-Heating Problems.' This contains a mass of well-digested expert information that is carefully indexed and readily available to those who design, construct, and have charge of steam-heating apparatus."—*Springfield Republican.*

"We look upon this book as a particularly valuable one in its lines. * * * The questions answered are such as are likely to come up to men practically engaged in the business embraced in the title. * * * We can confidently recommend this book."—*American Machinist.*

"The various problems relating to steam-heating are discussed intelligently, and there is a world of information given in its pages."—*Toledo Blade.*

Price $3.00, postage paid.

Address, BOOK DEPARTMENT,

The Sanitary Engineer & Construction Record,

82 & 84 FULTON STREET, NEW YORK

Obtainable at London Office, 92 & 93 Fleet St., for 15s.

SECOND EDITION.

PLUMBING AND HOUSE-DRAINAGE PROBLEMS;

OR,

Questions, Answers, and Descriptions from THE SANITARY ENGINEER.

With 142 illustrations.

"The book has a highly practical interest for house-builders and house-keepers, and for all persons interested in sanitary engineering."—*Cincinnati Commercial Gazette.*

"Of this book it seems hardly necessary to say anything beyond announcing its title. The imprint of THE SANITARY ENGINEER is enough to give it the stamp of authority upon the subject with which it has to do. It represents careful study given to one of the most important matters connected with our home life in these days of modern improvements, and one too often neglected, ignored, or misunderstood, to the serious impairment of health and happiness, and perhaps to the peril of life. The articles and illustrations explain some of the most difficult problems of sanitary science. They are answers in practical and concise form of inquiries made of THE SANITARY ENGINEER, and they are published in convenient book form for reference. The illustrations, one would think, cover every possible point that can be raised, and afford many hints which the intelligent house-owner and artisan will readily apply."—*Troy Times.*

"This volume contains replies to a very great variety of questions, all accompanied by cuts, some of them showing the errors which have been committed in work actually done, and others showing how it should be done. In the columns of the periodical this important advice was scattered through many numbers, and hence difficult of access. * * * In this book it is brought compactly together, classified as far as practicable, and so placed within easy reach of every man or woman who has occasion to build a house, or who cares to know something of what the plumbing should be in selecting a house for rent. Few people ever think of such things in selecting houses, and the result is an unfailing crop of diphtherias, etc., etc. A cursory glance through this volume will satisfy any thinking reader that it is valuable for any body to have conveniently at hand for reference."—*Chicago Times.*

"Of great service and interest to plumbers, builders, architects, engineers, and others."—*Boston Herald.*

"THE SANITARY ENGINEER, of New York, one of the most useful publications in the country, or perhaps in the world, has prepared a series of questions, answers, and designs, relative to house-drainage and plumbing, which, when they originally appeared, attracted wide attention. The questions cover every possible contingency in plumbing, involving every imaginable difficulty in the path of the plumber, to which answers are given that at once enlighten the practical mechanic and instruct builders how to proceed in this work. Such a publication ought to be in every house where plumbing machinery is ostensibly used, because as a book of reference it may be constantly referred to with benefit."—*Harrisburg Independent.*

"This work is invaluable to all persons engaged in the business of plumbing, and should be in the hands of every plumber in the country."—*Austin Dispatch.*

Large 8vo. Cloth, $2.00.

Address, Book Department, THE SANITARY ENGINEER AND CONSTRUCTION RECORD,

82 & 84 Fulton Street, New York. P. O. Box 3037.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 1. PUBLISHED EVERY SATURDAY.

NEW YORK, DECEMBER 4, 1886.

LONDON, DECEMBER 18, 1886.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 140 William Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

TABLE OF CONTENTS.

ANNOUNCEMENT.

WITH this issue THE SANITARY ENGINEER AND CONSTRUCTION RECORD begins its fifteenth volume. On one of our advertising pages will be found some idea of what we are able at this time to promise our readers for the coming year. Those who feel disposed to render us a service—and we frequently have evidence that there are such—will place us under obligations, make our labors easier, and our paper more interesting, if, when occasion presents itself, they will suggest to us where we may find something of interest to our readers to illustrate and describe. Newspaper clippings or items for our Personal and Contracting Intelligence Columns are always very welcome. Although we have an organization for the gathering of news items, yet our readers can often supply us with matter not otherwise obtainable.

THE FOOD OF THE PEOPLE.

LIFE is a conversion or special application of force, not the creation of it. Hence a living man is, in one sense at least, a machine which must be supplied with power from without, and this is for the most part given in the shape of force stored up in various chemical combinations, all of which are included under the general term "food." The number of people who can exist upon the earth must therefore be proportioned to the amount of food which the earth is capable of producing.

If the *beau ideal* of most writers on sanitary science and political economy could be realized all over the world, we should have the living population of the earth doubling every thirty years or thereabouts. Some philosophers in reflecting upon the results of such a rate of increase have concluded that the food-supply could not be increased in the same ratio for any great length of time, and that disease, vice, war, etc., are the natural checks to an undue increase of population. About one-half of human effort is exerted for the procuring of food—that is to say, about one-half the value of work done by the average man, as measured in money, is the equivalent of the food he consumes.

In an address given at the meeting of the American Association for the Advancement of Science in Ann Arbor, Mich., last year, Mr. Edward Atkinson points out that in this country "each average person must find shelter and be supplied with food and clothing out of from what forty to forty-five cents a day will buy, because such is the measure in money of all that is produced, and we cannot have more than all there is. Each person who is engaged in gainful occupation in this country sustains two others, and at forty cents per day the expenditure of three persons comes to $438 per year. What can be done for those whose income is less than forty cents a day for themselves and their children, and who must spend more than one-half for food? They are counted by millions even in our fair land." To comprehend the magnitude of the problem it must be remembered that to give each person five cents more per day would require an addition of over nine hundred millions of dollars to our annual product, and that if each person received an egg every other day, at the price of one cent per egg, the annual value of these eggs would equal the annual product of all our gold and silver mines.

Mr. Atkinson proceeds to answer the question he has raised, first by showing that the production of food in this country can be so enormously increased that it will serve for the needs of our growing population for centuries to come; and second, by an attempt to show in what directions economy is to be sought in the providing of food—*i. e.*, what articles of food are the most economical and what quantities of these are necessary. He gives a number of dietaries or rations for the use of laboring men and their families, with the cost of each carefully calculated, such cost varying from twelve to forty-five cents each, and these we commend for study. No doubt they are theoretical, and no one of them could be followed exactly, yet they are very suggestive, and any fairly intelligent man or woman can, from the data which he gives, provide a sufficiency of good food for much less than he or she is probably expending for that purpose at present. We print in another column a selection from these rations, and we think that a knowledge of them should be diffused as widely as possible among the people.

MUNICIPAL IMPROVEMENTS BY PRIVATE ENTERPRISE.

THE building of public works by private enterprise has become so extensive of late as to call for some comment. Within the last two years the number of private corporations organized for the purpose of constructing works for supplying water to towns, and in some instances for providing sewerage also, has been extraordinary. Many of these companies claim to have an exclusive right to some arrangement of detail or special form of machine which they call the Smith or Brown or what-not "system." Others again are simply contractors ready to build any kind of works. All are alike in one thing: they want to furnish their own plans and do the work without interference or dictation from the property-owners or officials of the town they select for their operations, and without being subjected to the criticism of an expert acting in the interest of the public. In the case of a water-works they demand the exclusive privilege of laying pipes and furnishing water and of collecting rents for the same, and also a public rental for fire-hydrants. There is a good deal to be said in favor of this way of getting a water-supply or a system of sewers. There are a great many towns where water and sewers are needed, but sufficient capital to build works cannot be induced to enter into the operation, and the taxpayers cannot be persuaded to vote in favor of issuing bonds for the purpose. In such cases an enterprising business man can do both himself and the town a great benefit by working up a scheme which will assure a supply of water to the town, at a small annual outlay of public funds, for fire protection, the projector taking the risk of remuneration by the sale of water to individuals.

The danger lies in the flimsy and insufficient character of most of the works constructed in this way. One may be pretty sure when a man or firm calls the particular specialty a "system," that everything else will be done in the cheapest possible manner, to insure the bulk of profit falling to the proprietor of the specialty, whether it be a pipe, a pump, a hydrant, or a stop-cock. The engineers employed to lay out the work (if there be any engineers at all) are frequently young graduates, or even undergraduates,

of some school of science, who lack the judgment and knowledge acquired only by experience.

We have heard of several cases where seekers for a privilege of erecting works have objected strenuously to having any surveys or plans made by the town, arguing that it was a useless expense, and that they could do all that sort of thing cheaper and better than the town could.

This is all wrong. There never was and never will be a contractor who should be trusted to fulfill his obligations without supervision from the other party to the contract. The only safe and sure plan for a municipality which has a water-supply under advisement, is to either have plans prepared by an experienced engineer, or to at least have all plans submitted to such a one for his criticism, and to have all work done under the supervision of an impartial expert. Even where works are not owned by the town, but a franchise merely is granted, the construction of the works ought to be after specifications and under supervision of an expert designated by the public authorities. Leaks and bursts in main pipes are a public nuisance, and the insuring of the durability of the works for water or sewerage for a long time in the future is of interest to the public, who will be dependent on those works long after the original projectors have stepped down and out.

WE quote elsewhere from the *Journal of Commerce* a note on the continuance of the peculiar system of quarantine, by which the business of importing rags is being driven away from New York and transferred to other ports where patent disinfection is not so specially favored.

It seems probable that the best way for our merchants to get rid of this yoke is to interest themselves in politics sufficiently to compel the appointment of some new men in the official positions connected with our port quarantine.

But, while we have been forced to this opinion and to the conclusion that no patent disinfecting process of any kind should be countenanced or aided by any quarantine authorities, we must remind our readers that the risk of importation of cholera is by no means over, and that, while the risk of its introduction in baled rags is so extremely small as to make unwarrantable the action which has been taken with regard to them at this port, we must be careful not to diminish precautions against its importation by personal effects or by bedding.

The *Times* of November 28 contained a telegram stating that cholera exists in Rio Janeiro, and in Paraguay, and that on the 26th of November there were 72 new cases, and 54 deaths at Rosario. We have therefore to guard against infected vessels from South American ports as well as from southern Europe, and we do not wish to see any relaxation in the vigilance of our quarantine officers, but only that it shall be turned in the proper direction.

RESIDENCE AT SOUTH ORANGE, N. J.—ROSSITER & WRIGHT, ARCHITECTS.

OUR BRITISH CORRESPONDENCE.

Experimental Borings for Natural-Gas—Steam-Supply from a Central Source—Admiralty Regulations for Boiler Examinations—Rousing Sleepers by Telephone—Subsidence of the Viaduct over the River Calder—Drainage Scheme for Richmond, Kew, Barnes, and Mortlake.

LONDON, November 17, 1886.

SIR EDWARD WATKIN writes to the *Morning Post* advocating a system of experimental boring at the public expense, with a view to discovering natural-gas. Instancing Pittsburg (U. S.) as an example of the advantages of the use of natural-gas, he states that there are some 150 manufactories and 1,500 dwellings supplied there exclusively with this gas, the result being a displacement of the consumption of 10,000 tons of coal daily, and that, owing to the absence of smoke, Pittsburg has become a clean country town, with coal obtainable for manufacturing purposes at 12*s*. ($2.88) per ton.

A scheme is reported from Berlin for the supply of steam to factory and heating purposes from a central depot, similar, I presume, to that in operation in New York.

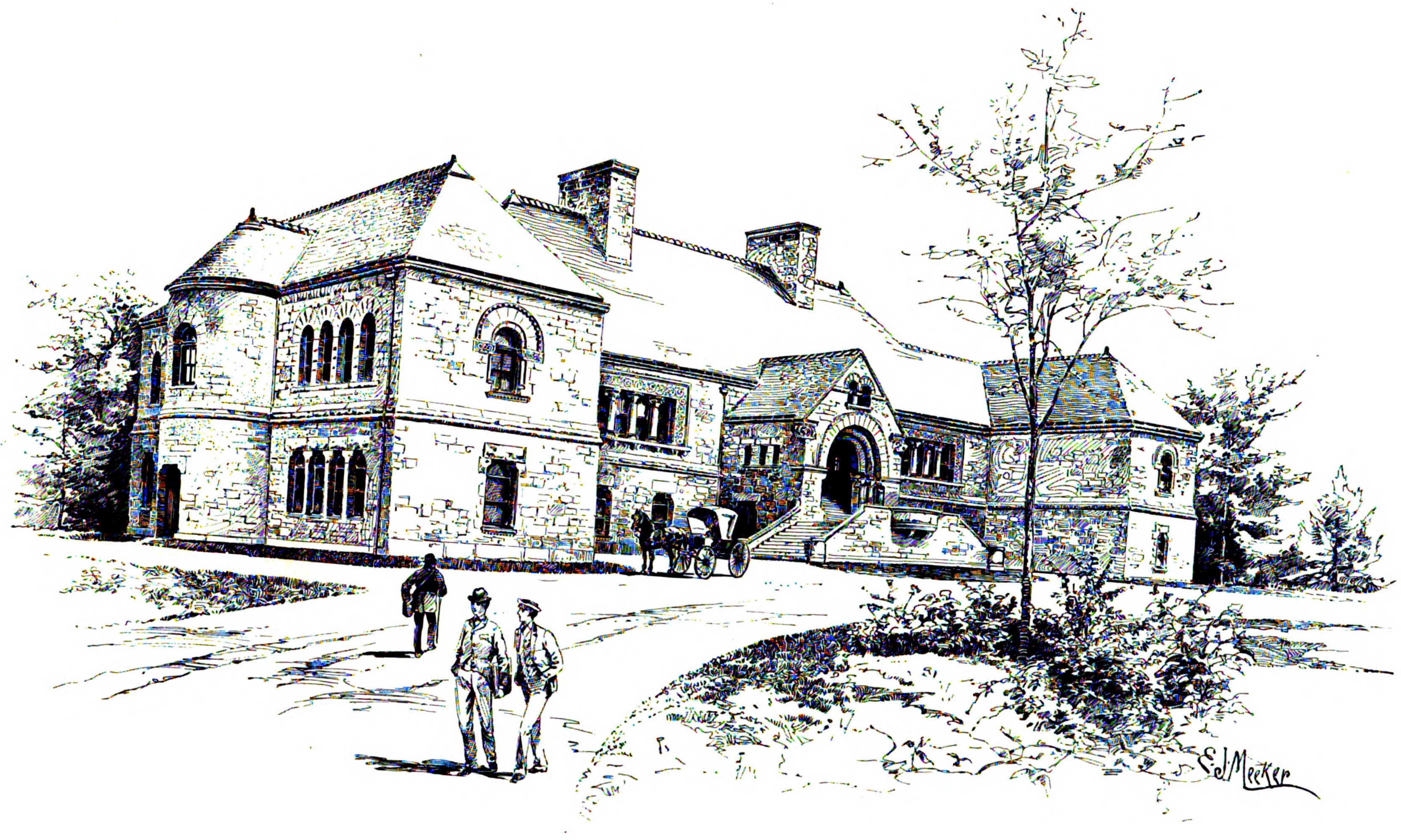
A new regulation as to boiler examination is issued from the Admiralty. Ships in commission are to be tested at intervals of not longer than two years, and no ship is to be put into commission without such testing. The examination is to be carried out by some engineer, senior to the officer in charge, who will drill-test at least one in every four boilers in such plates as he thinks most likely to be worn, and report their thickness.

I heard the other day of a new application of electricity in connection with telephone work in Brussels, instituted by the Telephone Exchange. Subcribers desiring to be called up in the morning at any stated hour may have bells fixed on their bedsteads, in communication with the Exchange. Before the current is turned off, and the bells cease to ring, the subscriber has to go to his own instrument and "ring-off."

A remarkable instance of subsidence is reported from Lancashire. A portion of the Lancashire and Yorkshire Railway crosses the River Calder on a structure known as the Whalley Viaduct, which comprises 48 arches. The banks of the river are of a treacherous nature, and were only recently repaired at great cost. After the Scotch Express had gone over, to-day, it was discovered that the whole structure had subsided 18 inches. The viaduct itself is uninjured, and no alteration has been made in the running of trains over it.

Inquiry is being held by Mr. Arnold Taylor, Inspector of the Local Government Board, into a scheme of drainage for Richmond, Kew, Barnes, and Mortlake. It is sought to obain sanction for borrowing £100,000 ($480,000 for the purpose. The engineer of the scheme is Mr. Mellis, M. I. C. E. The proposal is for an intercepting sewer for the existing Richmond sewer outlets into the Thames, in part 16-inch stone and 18-inch iron pipe from Richmond; through Kew and Mortlake it would take the form of an egg-shaped blue Stafford and Gault brick in cement and cement concrete 3' 3"x2'. At the point of receipt of the Barnes and Mortlake sewer this would be increased to 4' 3"x2' 10". It is intended to treat the sewage by precipitation. The effluent would be discharged on filters, occupying 1½ acres, consisting of coarse sand, shingle, and fine sand and carbon, and having a capacity of 383,000 gallons.

SAFETY-VALVE.

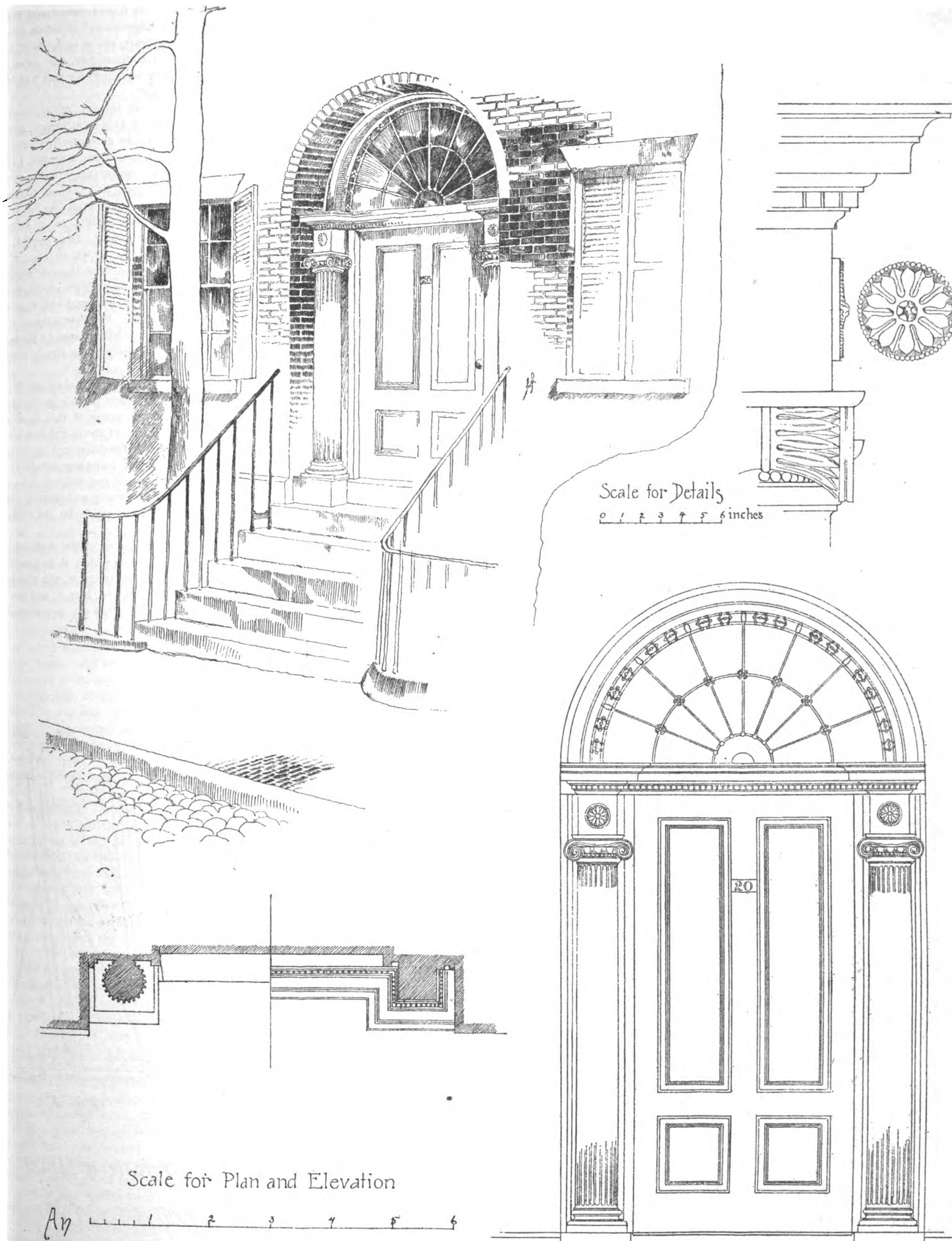


THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

MEMORIAL HALL, LAWRENCEVILLE SCHOOL, LAWRENCEVILLE, N. J.

PEABODY & STEARNS, ARCHITECTS.

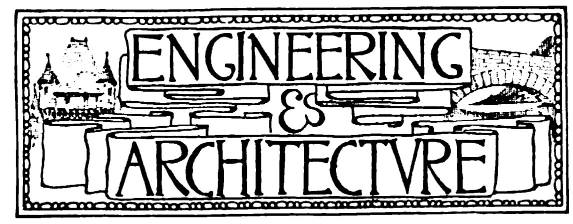
NEW YORK, VOLUME XV



An Old Doorway on Bulfinch St. Boston, Mass.

Henry Bacon Jr. Del.

"THE SANITARY ENGINEER"



OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE AT SOUTH ORANGE, N. J.—ROSSITER & WRIGHT, ARCHITECTS.

THE subject of our vignette illustration this week is the residence of Mr. Z. H. Mead, at South Orange, New Jersey. It is of frame, shingled exterior. Its color is brown, creosote stains being used. The first story is hard wood, with parquetry floors. Cost, $5,800. The architects were Messrs. Rossiter & Wright, of New York.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. II.

(Continued from Vol. XIV., page 613.)

ERECTION OF THE TOWERS OF ST. PATRICK'S CATHEDRAL, NEW YORK CITY.

AT the time of the erection of the Cathedral, the towers, of which there are two (one at each angle of the façade on Fifth Avenue), were left in an unfinished state, at a height of about 190 feet above the curb. The distance between the centres of the towers is about 75 feet, and the height to be added was about 137 feet. This work has to be done without interfering with the entrances to the church or the traffic in the avenue, and the plan adopted is both simple and effective. The slope or batter of the conical portion of the towers is 1¼ inches per foot rise, and it was decided to erect a scaffolding consisting of four compound continuous columns, suitably braced and tied, and having a slope parallel to that of the towers. This placed the base of the outer columns at about 24 feet from the vertical line inside of the buttresses, shown in Fig. 1. The inner columns were placed 2 feet 2 inches in the clear from the outer and 4 feet 6 inches apart, and were made up of two outer planks 3x12 inches, and two inner planks 3x6 inches, built up by successive laps, with a thorough breaking of joints, and held together by ⅝-inch bolts every 2½ feet, with less spacing at the joints. The interior grooves thus left, measuring 6x6 inches, serve as guides for a platform by which the materials for construction are hoisted. The planks are in lengths of 20 to 24 feet.

The outer columns are made up of three 3x10-inch planks, bolted with one ⅝-inch bolt every 5 feet, except an extra bolt at joints. Each pair of columns rests on and is secured to a 3-inch plank, bolted by ⅝-inch bolts to the pavement to prevent possibility of jarring out of place in use.

Vertically, the scaffolding is divided into bents of about 10 feet rise. To brace the columns advantage was taken of the buttresses, by carrying up against their inner faces a continuous line of 2-inch planks butting on each other. On the inner faces of these at each bent a wedge-shaped cut was made about a foot long and an inch deep at the upper end. A 6x6-inch stick 18 to 22 feet long had its ends similarly sloped, and by simply shoving this in horizontally between the planks it could then, by driving down, be readily wedged tight. The pieces thus fastened served as an attachment for 2x10-inch parallel braces which were spiked to the *outside* of the inner columns and the *inside* of the outer columns, and were notched 2 inches on the under side as an attachment to the 6x6-inch pieces described. Two by ten inch planks were braced between the inner columns and the outer angles of the buttresses by simply notching at the ends, and 3x6-inch braces ran from the outer columns to the interior angles at the back of the buttresses. These braces were spiked together at their intersections. The result of all is a very stiff and light trestle. The detail of wedging is shown with Fig. 1, and the arrangement of trestling in Figs. 1 to 4. In addition to the bracing mentioned the front columns were braced by 2x10-inch plank ties and diagonals well spiked on as shown.

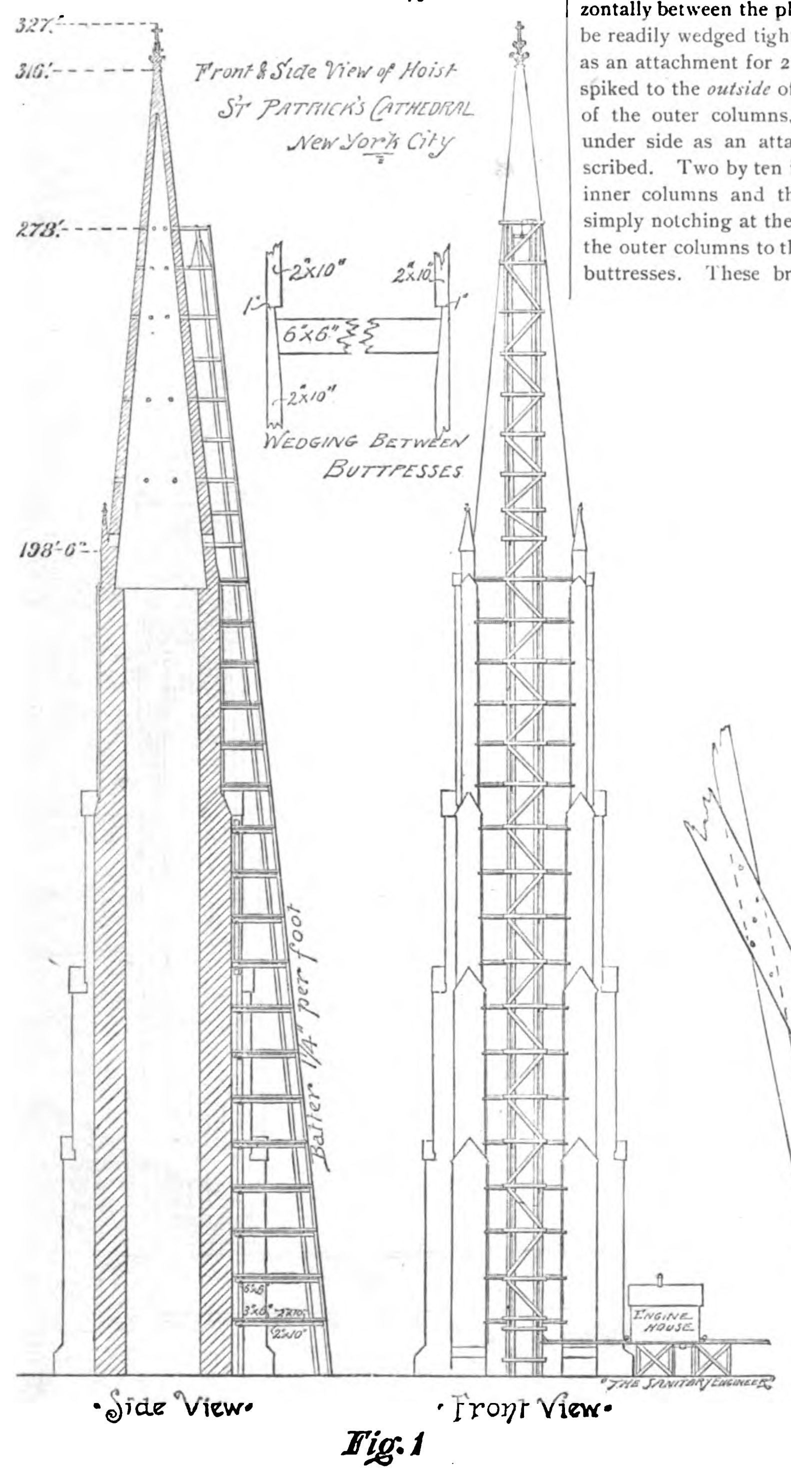
The trestles are in duplicate, one at each tower, and the platform-hoists are run simultaneously, one ascending as the other descends. The machinery for this will be illustrated in our next article.

The platform has an oak framing of 4x5-inch sticks attached to the uprights by 2x¾-inch straps, and a 4x6-inch cross-head attached to the uprights by mortising and ⅝-inch bolts, and by two looped angle-straps, 1x⅜-inch. The outer ends of the platform are supported by two 1-inch bent rods. The hoisting-rope is attached to the cross-beam and passes upward over a sheave at the top of the scaffold, thence horizontally to a second one at one side of the column next the engine, thence down to a leading block, as shown in Fig. 3, thence horizontally to the drums, and from them to the opposite trestle. Eight 3x1-inch friction-pulleys are inserted in the uprights of the platform, as shown, and the movement is very steady and without jerks. For this purpose it will be seen that a play of one inch is left all around the uprights. The pulleys are fastened in place by a simple staple over their axles.

When the loads arrive at the top they are lifted and swung to place by an ingenious derrick to be described hereafter. It is intended by means of this apparatus to build the towers to a height of about 278 feet, at which point they are about 10 feet in diameter; scaffolds will then be built around the spires, being supported on timbers through the openings shown at that height, and a special form of derrick adopted for hoisting and placing; the material being carried up within reach by the scaffolding, shown in Fig 1.

Above the buttresses the bracing of the scaffolds has to be changed, but the principle on which it is done remains the same. To save trouble in erection, the planks composing the columns are all matched, bored, and marked on the ground. The loads to be lifted do not exceed 3,000 pounds.

(TO BE CONTINUED.)



•Side View• •Front View•

Fig. 1

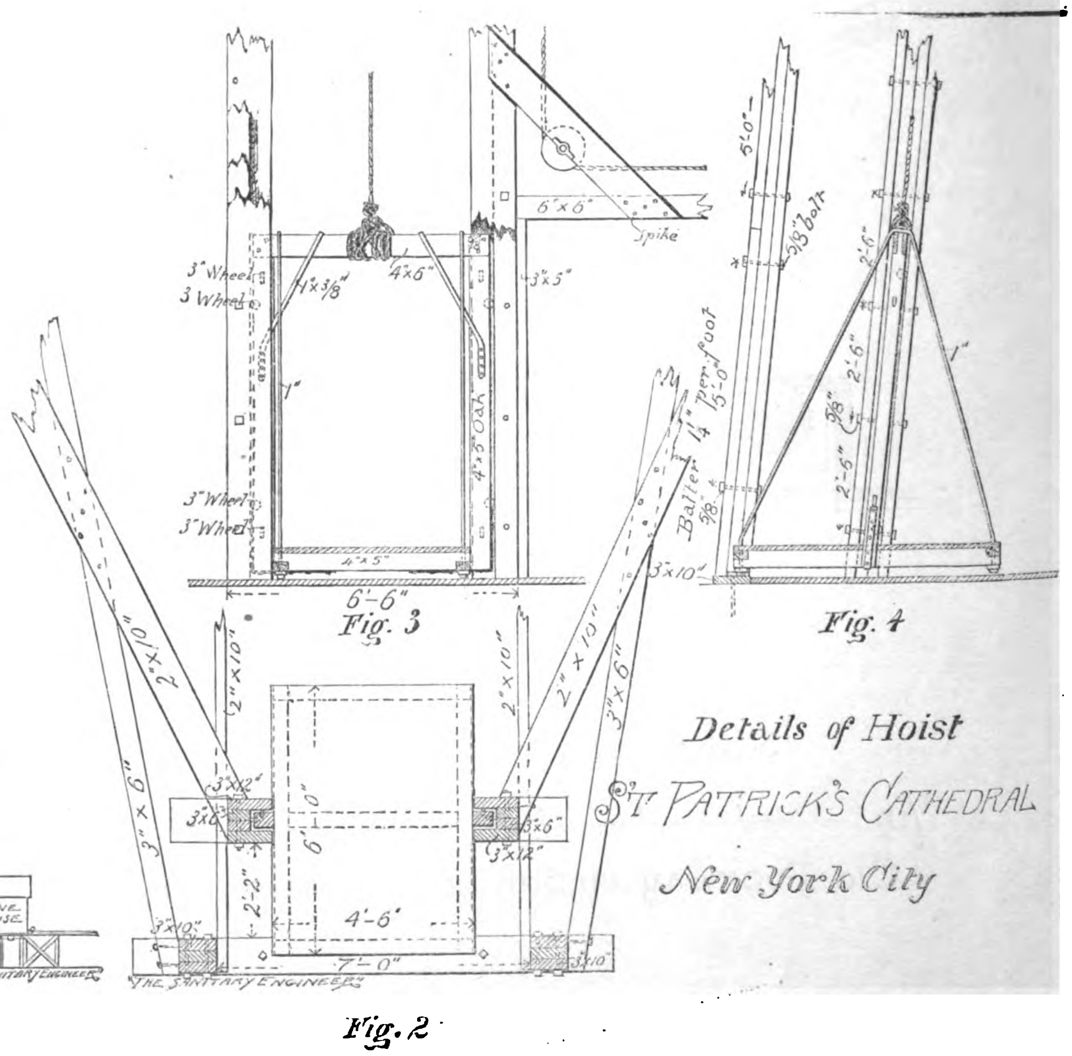


Fig. 2

MODERN SEWER CONSTRUCTION AND SEWAGE DISPOSAL.

BY EDWARD S. PHILBRICK, MEM. AM. SOC. C. E.

No. I.

A PROPER regard for the public health amid the rapid increase of population, and the tendency of that growth to congregate in large towns throughout the civilized world, during the past 50 years, has made the subject of sewerage one of the most prominent amongst the various public works demanded in consequence of such growth and aggregation.

Perhaps a larger number of towns have undertaken to provide a public water-supply than a system of sewers; yet if their local authorities have appreciated the risks incurred by providing a water-supply without sewers, they have not failed to urge the construction of the latter wherever the former has existed.

It is now proposed to look over the experience thus acquired and to discuss the question of sewer construction in detail, describing the best modern practice under the various circumstances and conditions by which the work has been surrounded in various places, and to weigh the comparative merits of the various plans that have been adopted. As the writer is not trammeled either by an experience limited to special methods or by personal interest in favor of any one system or method, a fair consideration of the relative merits of each will be attempted.

It is true that THE SANITARY ENGINEER AND CONSTRUCTION RECORD has repeatedly in the past fourteen volumes published able discussions of different systems of sewerage, and has also described various important works constructed during the same period. It is proposed now, however, to discuss the different methods of construction pursued, as well as the systems followed in the works alluded to, or such others as may occur to the writer, it being intended to interest the engineer who is about to design, construct, or maintain such works.

It will be assumed to begin with that the system of removal of fæcal matter together with all other kinds of fluid refuse of towns, by *water carriage*, has been practically adopted by the mass of the American people, as well as by the principal European cities. The reasons in favor of this system are so well known and so widely appreciated, when compared with any system of dry removal of fæcal matter yet devised, or likely to be, that it does not seem worth while to rehearse them to an audience that is practically already convinced and attached to the system of water carriage by some twenty-five years' use and a large investment of capital. Moreover, the reasons for such attachment and investment seem to be valid and of permanent force.

It is also generally agreed that a due regard for health requires all towns which have a public water-supply to provide at once a system of drains whereby the dirty water shall be removed to a suitable place, and so disposed of as to work as little harm as possible.

Many volumes have been written and many millions of dollars spent in the effort to render such refuse of some economic value to the population.

All chemists attest the intrinsic value of sewage, as a manure. There is no dispute about this fact. The vegetable world is known to subsist upon the waste and refuse of the animal world, and to render innocent—yes, beneficent—the masses of corruption which would otherwise breed pestilence in every large town. The difficulty of availing ourselves of this natural law is a practical or economic one. So far as our present experience goes, it may be laid down as a melancholy fact that however much value there may be in sewage as now collected, it costs more to apply it to agricultural crops, when obliged to take the *whole* volume of water, than can be recouped by the sale of such crops. Sewage is often applied directly to the land, and various mechanical and chemical processes have been tried for getting rid of the surplus water, which forms the bulk of sewage, and for separating the valuable parts in a portable and salable form. These processes will be referred to hereafter under the head of "Sewage Disposal." We will first consider the best methods of collecting it.

Long before sewers were thought of as a means of carrying away house refuse from our large towns, they were provided for the purpose of surface drainage to remove the surplus rain-water from the streets, roofs, and yards, more or less polluted by the surfaces over which it flowed, and combined more or less with the natural flow of such small streams as chanced to run through the heart of the town.

Baldwin Latham states, when speaking of English towns, that "it was illegal, prior to the year 1815, to pass fæcal matter into sewers."

Still later another kind of drainage has been found important to the preservation of health—the removal of ground water to a considerable depth below the surface of the ground under dwellings. Many towns are favored by Nature in being built upon a porous subsoil through which such water percolates freely to a sufficient depth to be out of the way, but many others are so located that an impervious stratum prevents such natural drainage, and artificial means should be resorted to, to keep the ground-water down.

It is in combining or separating these three kinds of drainage—viz., the house refuse, the surface water, and the ground water—that a great variety of practice has prevailed, which we will proceed to describe in a series of articles.

(TO BE CONTINUED.)

RAINFALL AND EVAPORATION.*

THE value of investigations of the nature of those recorded in these two papers cannot be overestimated. They are practical and accurate observations of natural phenomena concerning which speculation is vain and fragmentary records are misleading. The rainfall and flow records compiled by Mr. Brackett cover a period of twenty-three years for the Cochituate, of eleven years for the Sudbury, and of eight years for the Mystic. It is worthy of note that the records of the last twelve years show an average precipitation much below the mean of a longer period. The years 1880 and 1883 were years of very small rainfall, and the amount of water collected and stored in the ponds and lakes was also much below the average. From the records it is shown that in 1883 the amount of rainfall collected was only 10.11 inches on the Cochituate water-shed, 11.02 inches on the Sudbury, and 9.32 inches on the Mystic. From this Mr. Brackett concludes that "it is not safe to assume a collection of more than 10 inches in a year of extreme drought. This is an important fact. Heretofore the estimates of engineers have been based on much larger assumed collection of rainfall. The "million a mile" fallacy, which was attractive from its alliteration, was exploded long ago by Mr. Kirkwood, who first took up the subject of rainfall and flow systematically, but Mr. Kirkwood thought that he was acting carefully in advising the limitation of estimates to twelve inches collectible rainfall per annum, or about 600,000 gallons per day from each square mile of drainage area. In the light of the Boston records, he will be a rash engineer who ventures to predict a certainty of collecting and distributing more than 500,000 gallons per day from each square mile of drainage area.

Mr. Fitzgerald's paper is a valuable record of a very interesting and thorough series of experiments. The writer states that having experimented for some years and accumulated a certain amount of data, he found on attempting to put them into shape for publication that to elucidate both the theory and the practical part of the subject extensive and systematic experiments had to be undertaken. Fortunately, the Boston Water Board was composed of men who were able to appreciate the value of such work, and they afforded Mr. Fitzgerald the necessary facilities for making the experiments recorded here in forty-two pages of letterpress, eleven plates, and seven tables.

The literature existing on the subject is exhaustively summarized, the writer's experiments fully described, and the conclusions arrived at clearly stated.

The mean curve of evaporation as deduced from the experiments is as follows, for a large body of water:

	Inches.	Per cent.
January	0.98	2.51
February	1.01	2.58
March	1.45	3.71
April	2.39	6.11
May	3.82	9.76
June	5.34	13.65
July	6.21	15.87
August	5.97	15.26
September	4.86	12.42
October	3.47	8.87
November	2.24	5.73
December	1.38	3.53
Total	39.12	100.00

This corresponds in form very closely with the mean curve of temperature for fifteen years from the records of the United States Signal Service at Boston.

One curious fact developed was, that the evaporation during the day and the night is very nearly the same.

To appreciate the work done by the investigator the whole paper must be studied. Copies can be obtained from the Secretary of the American Society of Civil Engineers, 127 East Twenty-third Street, New York City.

* (1) Rainfall Received and Collected on the Water-Sheds of Sudbury River and Cochituate and Mystic Lakes. By Dexter Brackett, C. E. (Journal Assoc. Eng. Soc., Sept., 1886). (2) Evaporation. By Desmond Fitzgerald, C. E. (Trans. Am. Soc. C. E., Sept., 1886).

MINNEAPOLIS BUILDING REGULATIONS.

THE City Council has recently passed an amended building ordinance. One of its provisions restricts the height of commercial buildings to 125 feet, but this is not to be construed as relating to steeples, towers, cupolas, or pinnacles. It is also required that the carrying capacity of floors in business buildings shall be certified to by a competent architect, and the minimum carrying capacity is fixed at eighty pounds to the foot. All buildings six stories in height or over must be fire-proof, but iron shutters are not required for fire-proof buildings as in the old ordinance.

Special changes are made in the plumbing and sanitary regulations of the old ordinance. Plumbers must be licensed. The use of a running trap and fresh-air inlet is made optional, except in the case of unventilated sewers and cesspools. The soil-pipe known as "extra heavy" must be used in all work. The old ordinance required "extra heavy" pipe only where the length of pipe was over fifty feet. The use of an approved substitute for back-ventilation in traps is allowed. The connection of steam-exhausts with soil-pipes and the use of pan water-closets are prohibited, while the use of wooden cesspools is authorized.

PHILADELPHIA ENGINEERS' CLUB.

AT the meeting of November 6 the following were elected active members: Louis S. Wright, G. D. Chenoweth, Albert Millet, William D. Hewitt, A. E. Harvey, Jr., H. A. Schofield, Amasa Ely, and Arthur Marichal.

The Secretary presented, for Mr. W. E. Hall, a paper on "Car Lubrication."

Mr. Frank A. Hill presented a paper upon "Accidents in Anthracite Mines." Roof-falls kill 44 per cent of those who lose their lives in the mines. Carelessness of the men is the greatest danger and the one hardest to meet. The importation of unskilled foreign labor joins ignorance with carelessness in swelling the death rate. Roof-falls, explosions of fire-damp, and careless handling of powder, furnish at least 60 per cent. of the deaths. In almost every case these accidents are due to the carelessness of the men; ten per cent. is a very high estimate of the accidents for which officials are responsible. From 1875 to 1885 (11 years) in Great Britain the average number of tons mined to one life lost was 130,555; in the anthracite region of Pennsylvania, 102,608. There are no breakers in England, and as we waste in the breaker one-third of the material hoisted from the mine, 50 per cent. should be added to the shipment to obtain our true production. The English miner uses about $\frac{1}{15}$ as much powder as the anthracite miner, so that $\frac{14}{15}$ of the accidents from powder, as well as all accidents in the breaker, must be eliminated in a fair comparison. With these corrections made, the average number of tons mined in the Pennsylvania anthracite mines was 181,252 tons per one life lost, as against 130,555 in Great Britain.

The Secretary presented, for Mr. George R. Henderson, a paper on the "Efficiency of Locomotives and Resistance of Trains."

The Secretary presented, for Mr. Herman Haupt, Jr., a description of the St. Paul Ice-Palace, illustrated by photographs and prints.

COMMERCE DRIVEN AWAY.

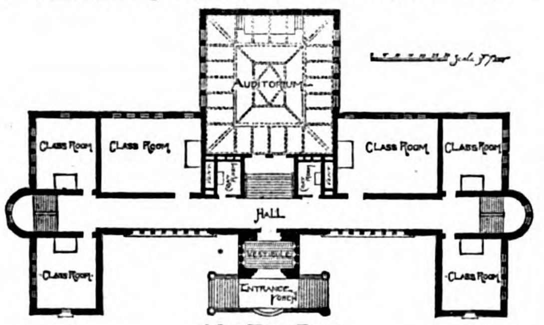
HEALTH OFFICER SMITH has pretty effectually driven the rag importation business away from this port by his rigid requirement of disinfection. The charges thus imposed amount to about \$6 per ton, or 20 per cent. of the value of the rags. The raw material of paper manufacture is thereby subjected to an import tax equal to that borne by the manufactured article. This pays 15 per cent. duty, amounting, at \$80 per ton, to \$12 duty. As it takes two tons of rags to make one ton of paper, the \$12 quarantine charges on the free article equals the \$12 duty on the dutiable one, and thus completely nullifies the intention of Congress to make paper stock free.

The consignees of the cargo of the Sonntag, from Kioto, who were refused permission to land their cargo here without disinfection, recently saved about \$4,000 by sending it to New London and Perth Amboy, where the health authorities, though carefully warned by Dr. Smith, found no reason to repulse the commerce thus sent away from New York. The rags were certified by the importer, whose assertion was fortified by three Consular certificates that they had not been gathered nor taken through a district having any infectious or contagious disease. Dr. Smith is on record that he will admit rags where the Consuls giving such certificates are first instructed by their Government to make them. Upon this small technicality, observance of which would not increase the value of the certificates by a microscopical quantity, the health officer is driving away the commerce of New York, and making a present of it to the other ports along the seaboard. They are ready enough to receive it.—*Journal of Commerce.*

THE LAWRENCEVILLE SCHOOL.

THE Lawrenceville School for Boys is located in the small hamlet of the same name on the high road about half way between Trenton and Princeton, N. J. As an educational institution it is one of the oldest of its kind in the State, if not in the country, but, until quite recently, it was very modestly installed in the few old buildings which had served a purpose for generations, but which were far behind the requirements of a lively, progressive enterprise such as the Lawrenceville school felt itself to be. The late John C. Green, of New York City, who was himself a graduate of the Lawrenceville School, by will left the residue of his estate, amounting to several millions of dollars, to his wife, his brother, Judge Caleb S. Green, his nephew, Charles E. Green, and his friend, Judge John T. Nixon, to be used by them for educational, friendly, and other purposes. These residuary legatees placed at the disposal of the school trustees a sum of money amply sufficient to cover the expense of erecting new buildings throughout, and of placing the institution upon a thoroughly first-class footing. The trustees showed that they fully realized the necessity of carefully studying out the problems involved in such an undertaking. The services of Messrs. Peabody & Stearns, architects, were secured to design and superintend the erection of the buildings, Mr. Frederick Law Olmsted was commissioned to lay out the grounds, and to Mr. J. J. R. Croes, Mem. Am. Soc. C. E., and M. Inst. C. E., was intrusted the planning for the water-supply and sewerage. Work was begun on the buildings in the summer of 1884 and continued through the greater part of 1885, consequently the school has been occupied less than two years.

The ground occupied by the school is nearly a parallelogram, with a frontage of 1,000 feet on the old Post Road, from Trenton to Princeton, and sloping south-eastwardly for about 2,100 feet to a small brook which flows through the property a few feet from its boundary, and about forty feet lower than the north corner of the tract. The surface at the time of its purchase was in its natural state, slightly undulating, chiefly occupied as farming land, entirely without artificial drainage. The school buildings were huddled together near the road about the centre of



MAIN FLOOR PLAN
MEMORIAL HALL.

the frontage. The water-supply was drawn from wells on the premises, and the privies were of the ordinary rural best types.

The general plan, Fig. 1, and the bird's-eye view published herewith will make the relative arrangement of the buildings easily understood. The scheme includes a large central building, now designated as the Memorial Hall. Near the entrance of the grounds is the residence of the Head Master, and located about the large open space fronting the Memorial Hall are four masters' houses. Both the plan and bird's-eye view show two additional master's houses as well as a chapel at the side and two dormitories at the rear of the hall. None of these have actually been erected, though it is intended to erect them, whenever the needs of the school shall call for them, and they were therefore considered in making up the general plan.

It should be explained here that the sketch of the chapel in the bird's-eye view we publish was not made from any drawing of the architects, but was merely intended by the artist who drew the picture to indicate the prospective location of the structure.

Each master's house is of sufficient size to allow in general eight rooms for the master and his family, besides accommodation for twenty boys. The boys' rooms are, of necessity, arranged together, but it is intended that each Master's house shall be as a single household, all eating at the same table and sharing a common sitting-room, hall, and stairway. The master has a private study, with a separate entrance, and the master's family has a small sitting-room, but all other house privileges are shared in common. The head master, from his position and the greater social duties incumbent upon him, has a house to himself.

The boys' sleeping rooms vary in size from 630 to 1,700 cubic feet of space for each occupant, with an average of 900 cubic feet. Each house has six single bedrooms, and six suites consisting of a study and two bedrooms. In no case do two boys share the same sleeping-room. Each bedroom has a fair-sized closet, fitted with hooks, and a chest of drawers. The height of stories is 10 feet 6 inches in the first, 9 feet 6 inches in the second, and 9 feet in the third story. All rooms have top and bottom ventilating registers, and the rooms connect with large brick exhaust-flues. The heating is entirely by indirect steam.

The boys' rooms are arranged on the sunny sides of the building and by preference on the south and west, so that there is not a room which does not receive sunshine during some portion of the day. Another feature of the plan is that the dining room and kitchen are in a wing by themselves. The dining-room is so situated as to receive the morning sun, and as it occupies the entire width of the wing there is every facility for thorough cross-ventilation. Immediately adjoining the dining-room, and separated from it only by a wide sliding door, is an apartment designated as the lounging-room, where the boys can meet and talk or have social evenings, if desired, without interfering with the master's own family arrangements. The family rooms are grouped together, and have a private bath-room and water-closet. For the boys there are water-closets on each floor, enclosed with brick walls and reached by a short passage which opens directly out of doors, and cannot be shut off from the outside air. Each water-closet has a 12x16-inch brick ventilation-flue. There are no baths for the boys in the houses, but in another portion of the school grounds a commodious bathing-house has been erected for their special benefit.

In construction the foundations are heavy rubble-stone-work and the superstructure of brick. The original intention was that the floors should have a mill frame of heavy hard-pine timber spaced three or four feet apart, and that the partitions and furrings should be of solid plaster blockings; but from considerations of expense this scheme was abandoned and the ordinary internal wood construction was adopted.

The Memorial Hall includes twelve large class-rooms, arranged in two stories, and intended to accommodate 300 pupils. The stories are fourteen and fifteen feet in clear height. Besides the class-rooms, there is, in the lower story, a room 51x55 feet designed as a study and examination-room, above which is the large hall, used for exhibitions, class-days, etc. The exterior walls are 22 and 18 inches thick, faced with Longmeadow brown sandstone, and backed with local rubble-stone. The interior partitions are entirely of brick, not less than 12 inches thick.

The new buildings at present erected include the

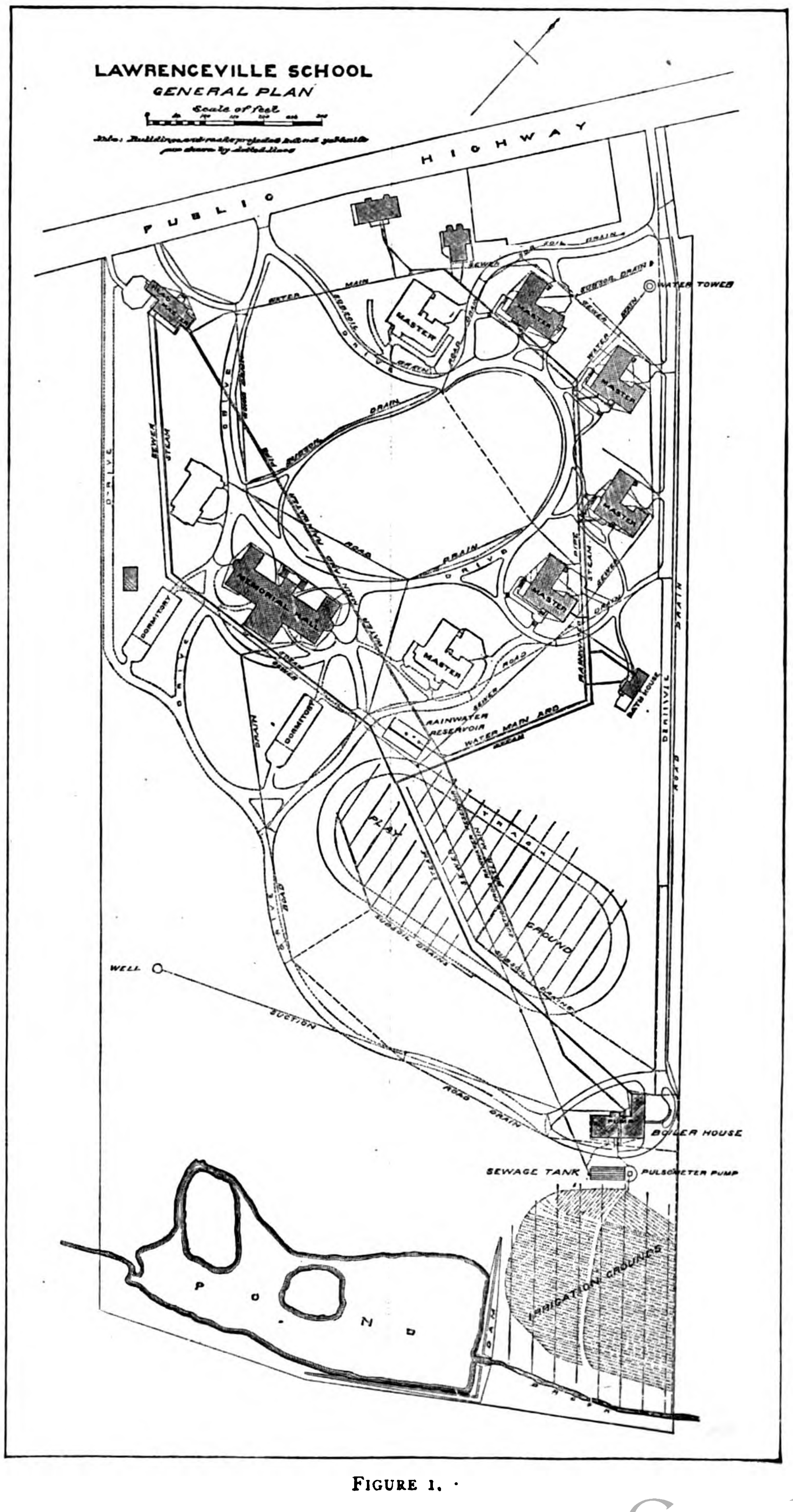
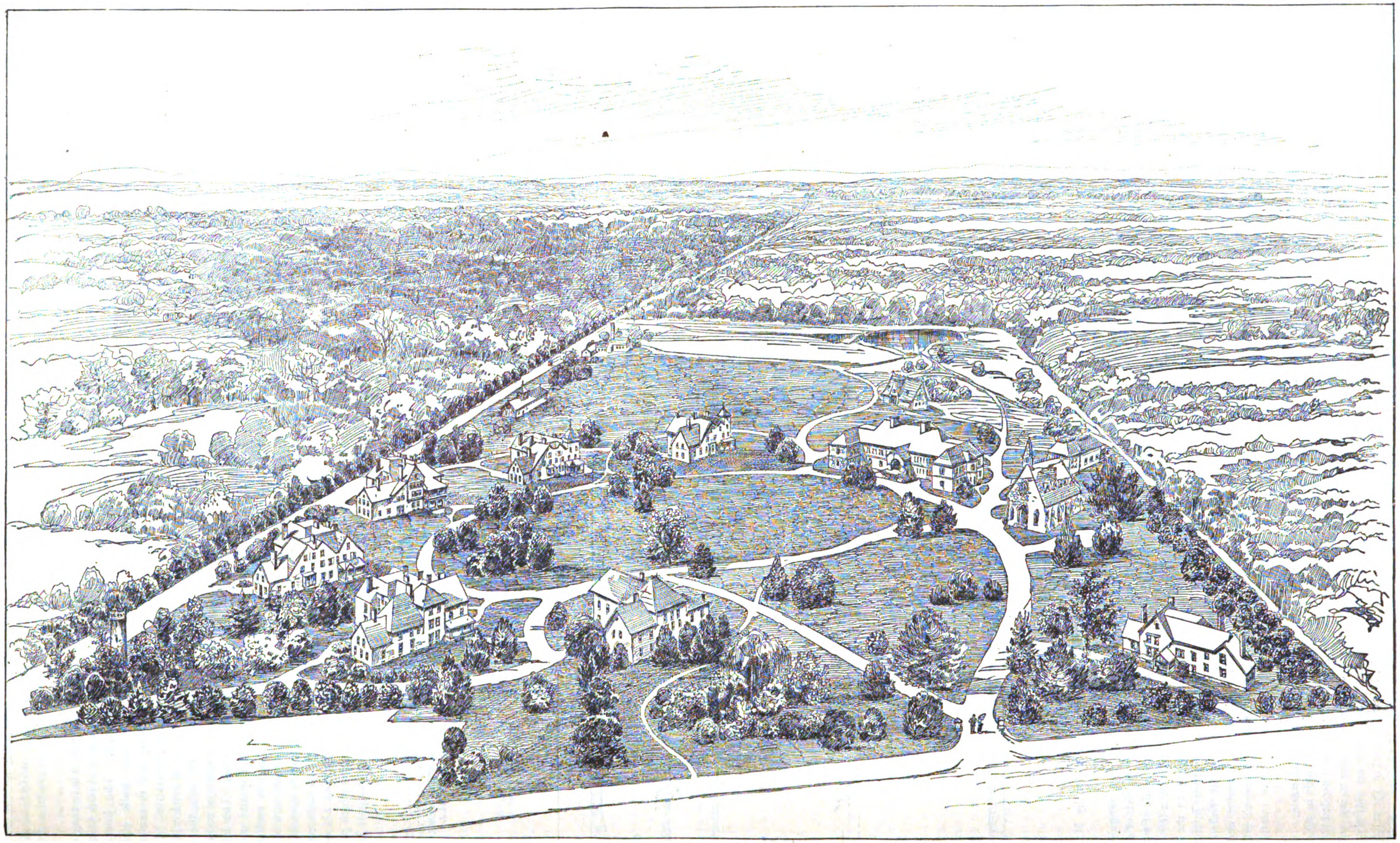


FIGURE 1.



BIRD'S-EYE VIEW OF THE LAWRENCEVILLE SCHOOL, LAWRENCEVILLE, NEW JERSEY.

Memorial Hall, head master's house, four masters' houses, bath-house, boiler and pumping-house, and water-tower. The general plan provides for the ultimate construction of a gymnasium and chapel, as well as additional masters' houses.

WATER-SUPPLY.

The water of the brook which traverses the property is not suitable for domestic use. The course of the stream is through cultivated lands generally highly manured in the spring, and the flow is very small in the summer and exceedingly irregular at any time. It is a "quick" watershed, and after even moderate rainfalls the water is very turbid. As a surface-supply under these circumstances was not practicable, for want of storage-room and settling facilities, examinations were made looking toward a supply from the ground-water.

In a swale near the south corner of the property there were indications of a supply from springs, and borings made there showed the presence of considerable water, but analyses made gave evidence of pollution from sewage, for which no good reason seemed to exist, especially in the one yielding the most copious supply.

This boring was in slight depression toward the southeasterly portion of the grounds, and it was found on examination that near the beginning of the swale, and more than 500 feet from the well, an old drain conveying the waste-water from the kitchen and laundry of the old dormitory building had its outlet, thus explaining the mystery of the contamination of the water.

Further experiment established the fact that when large draughts were made upon this well the impurities greatly

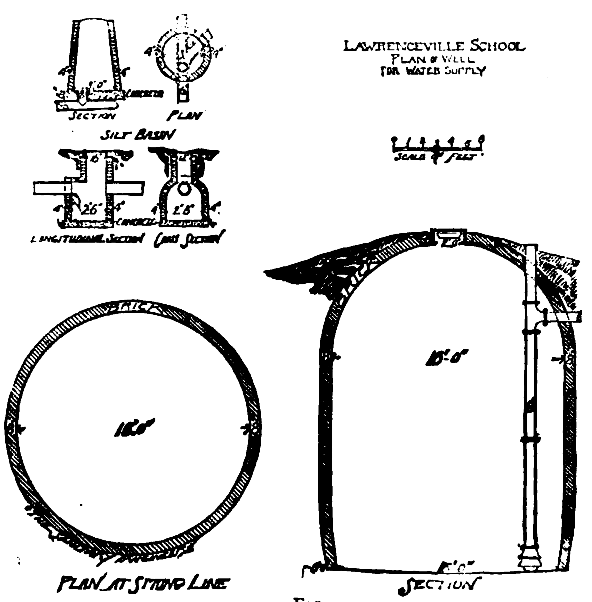


FIG. 2.

lessened, and, finally, after three days' continuous pumping, a sample of water was taken that gave a very good analysis.

As it was thought to be proven that a well at this point would yield a sufficient supply of good potable water when the evident source of contamination should be removed, the location was selected for a well for a permanent water-supply. Eighteen months later, when the new system of sewers was in use and the old drain had been abandoned over six months, samples of water taken from the same boring gave an excellent analysis.

WELL.

A well sixteen feet in diameter and twenty-three feet deep was sunk, the normal level of the water being three feet below the top. (See Fig. 2.)

The material encountered in the excavation was clay for six feet below the surface, and then loose brown sandstone, which came out without blasting and which was so unsound as to make it necessary to line the well with eight inches of brick throughout; this was done, leaving weep-holes at frequent intervals through the lower portion. The lining was brought up to a dome at the top and keyed by the cast-iron frame of a perforated manhole cover two feet in diameter.

The water is drawn from the well by a Worthington steam-pump in the boiler-house, 800 feet distant, through an 8-inch cast-iron suction-pipe, which enters the well vertically and is provided with a foot-valve and air-chamber. The suction-pipe is laid level, and when the well is full the water flows to the pump by gravity.

The pumping-main is of 6-inch cast-iron pipe for 700 feet, to the "campus," where it branches, one line of 6-inch pipe following the line of the easterly buildings for 800 feet, and a 4-inch branch following the line of the westerly buildings and the north front of the property for 2,300 feet to a connection with the 6-inch line, where a 6-inch branch 200 feet long leads to the water-tower. There is thus a complete circulation whether the supply be taken from the tower or directly from the pump. There is a check-valve near the pump and nine stop-cocks on the mains, with six fire-hydrants so placed that with 400 feet of hose two streams of water can be thrown on any building.

The water-tower, erected under instructions to make it as inexpensive as possible, is a plain cylindrical shaft of plate-iron ten feet in diameter and eighty-five feet high, with all joints lapped, the vertical ones being double riveted for twenty-eight feet above the bottom, and all others single riveted. The plates are of one-fourth, three-sixteenths, and one-eighth inch, and the bottom is of ¼-inch plate.

The tower stands on a foundation of rubble masonry, seventeen feet in diameter and eight feet deep, laid in cement. Four lugs riveted to the tower are connected with wrought-iron bolts passing down through the masonry.

The leaders from the roofs are carried down to the depth of four feet underground, and the carriers to the reservoir are of 6, 8, and 10 inch vitrified salt-glazed stoneware pipe, laid true to the line and grade, and the joints made with Portland cement.

The reservoir (see plans) is rectangular and is built in a pit excavated in the clay and rock to sixteen feet below the surface of the ground. The interior dimensions are 36½x67 feet, with side walls eighteen inches thick of rubble-stone masonry laid in cement and well backed against the sides of the excavation. Inside of the stonework is a 4-inch lining of brick with a 2-inch coating of cement-mortar between the two, the whole being covered with brick arches in two spans of seventeen feet six inches each (see plan and sections). The bottom is of concrete, with a surface coating of Portland cement. The interior surface of the brick lining was washed with a preparation of castile soap and alum in solution to render it more impervious to water, ten pounds alum and fifty pounds castile soap being used in giving two coats over a surface of 2,700 square feet and costing about 2½ cents per square foot. This preparation is the same which proved efficient on the walls of the Croton reservoir gate house in 1862, and is

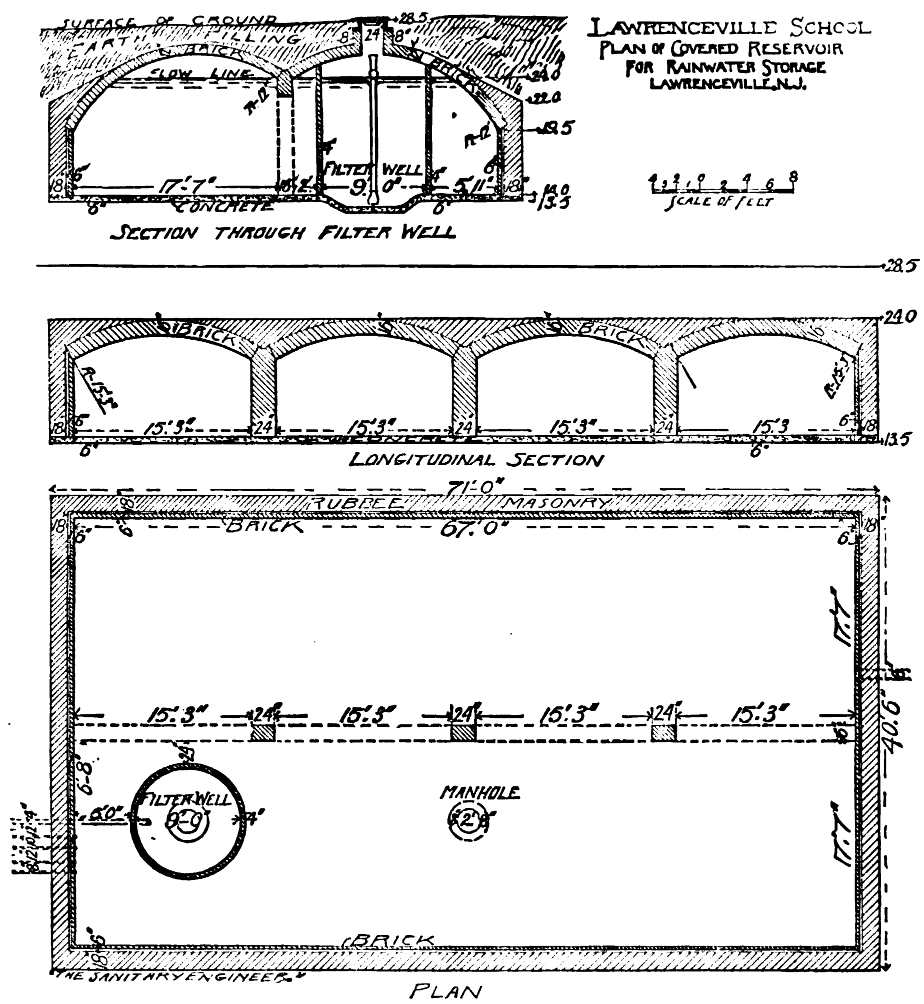


FIGURE 3.

It is only fair to state that the water-tower in its present unsightly condition is by no means the result of any oversight on the part of the architects or engineer. It was to have been inclosed in masonry, so that vines might be trained over it, but this scheme was temporarily abandoned, and the tower as it stands is a fair example of the extent to which a purely utilitarian structure of such dimensions may injure the effect of an artistic group of buildings.

The capacity of the well to furnish a full supply at all times was not considered to be demonstrated with sufficient certainty to warrant the rejection of any auxiliary supply which might be found available. Moreover, while not hard enough to be absolutely objectionable for steam-boilers and for the laundry, it was not a very soft water. It was considered desirable, therefore, to utilize the rain-water which should fall on the 55,000 square feet of slate-roof surface of the buildings on the plateau by erecting a covered reservoir on the hill.

The rain-water pipes from the roofs were therefore led by an independent line of pipes to such a reservoir built underground at a point near that building in the group which was nearest to the boiler-house. (See Fig. 3.)

fully described in the paper by Mr. W. L. Dearborn, Trans. A. S. C. E. I. 203.

The reservoir will store 162,000 gallons.

The filter-well within it consists of a circular 4-inch brick wall nine feet in diameter, inside of which is a 4-inch cast-iron suction-pipe provided with a foot-valve and an automatic air-valve, and leading to the boiler-house 720 feet distant. The water from it was intended to be used in the laundry and for feeding the boilers, but can also be pumped directly into the mains and used in any emergency should other sources become exhausted. Its capacity is equivalent to six inches of rainfall on the roofs which now feed it.

DRAINAGE.

That portion of the grounds in which the buildings are located is generally dry and needed little subsoil drainage, but it was deemed advisable to lay subsoil drains near the buildings, and in three cases entirely around the foundation-walls, below the level of the cellar floors, so as to insure their being dry at all times. Subsoil drains were also laid along the drives and walks, and the entire play-ground was underdrained by parallel lines of subsoil drains laid thirty feet apart.

These subsoil drains are of round agricultural tile from one and one-quarter to two inches in diameter, laid on uniform grades about three feet below the surface, with their outlet in the nearest road-basin.

To provide for the surface drainage of the drives and grounds a complete system of drains was laid following the general direction of the drives, with catch-basins (see Fig. 1) opening from the gutters at intervals of about 300 feet. The drains are of salt-glazed stoneware pipe from six to eight inches diameter, laid three feet six inches underground, with joints of Portland cement-mortar, their outlets being in the brook at the lower portion of the grounds.

The writer is requested by Mr. Croes to say that he is now convinced that in designing the outfall system a mistake was made in the size of the pipes. It was thought at the time that the large extent of lawn surface on very flat slopes and the deduction of the roof area from the watershed would so materially diminish the discharge from the rainfall that a capacity of carrying off 100 cubic feet per minute, or about an inch and a half of water on the road surfaces per hour, would be sufficient.

The experience of the last six months has shown that this is not sufficient, as the road-drains have been overtaxed three times during that period, causing pools of water to be formed for over an hour in some depressions of grade, and on the lower level near the engine-house, causing the water to flow out through a manhole and flood the boiler-room floor.

This was undoubtedly partly caused by two departures from the plans for constructing and operating the works.

First—The authorities neglected to complete the side drainage of the road in front of the property, and thus a large quantity of water flowed across the road and on the school grounds, from an extended slope on the opposite side of the road.

Secondly—The supply from the well having been plentiful the steam-engineer in charge of the boiler-house found it easier to draw all the water from that source than to open and shut the cocks changing the pump-suction from the well to the rain-water reservoir, so that the latter was never used, and all roof-water was discharged into the road-drains at their connection with the outfall-pipe.

But even if due allowance is made for these irregularities, it is not unlikely that in the case of a heavy rainfall when the ground on the campus is frozen, the capacity of the outfall would be found to be too small. A direct connection has therefore been made between the junction of drains at the reservoir overflow-pipe and the pond, by a 12-inch pipe, making the total capacity of discharge 450 cubic feet a minute. It remains to be seen whether this will be sufficient.

SEWERAGE.

The necessity of disposing of the sewage within a limited area of the grounds made it imperative that its volume be limited to a minimum, and therefore all surface or subsoil drainage was excluded from the sewers, and disposed of as previously related; then, to insure positive immunity from leaky joints, it was decided to carry it in 6-inch cast-iron pipe, 25 pounds to the foot, with leaded joints.

They were coated with coal-tar varnish, as were all the cast-iron pipe used on the grounds.

There are two branch lines, with a flushing manhole at the head of each. The lines are selected to serve every building with as short house-connections as possible, and all deflections are made by special curved pipe. A manhole is placed at every change in line or grade, and access is had to the sewer through a tee at the bottom of the manhole, and also at the junction of house-connections with the main line, where the Y-branch has cast in connection with it a vertical tee, from which a pipe is carried up to the surface of the ground.

Any manhole may be used for flushing purposes. The flushing and cleaning is done very effectually by using a "pill," or spherical hard-wood ball, $5\frac{1}{4}$ inches in diameter. This has proved more effective than one of smaller size.

The two branch-sewers unite near the rain-water reservoir, and continue to the boiler-house and laundry, near which is placed the sewage-tank, in which the solid matter in the sewage is allowed time to deposit itself on the bottom and the partially clarified liquid is retained until it is desirable to discharge it into the subsurface tiles.

SEWAGE DISPOSAL SYSTEM.

The sewage-tank is built of brick-work underground, and is in two sections (Fig. 4.) The first or retaining section is in duplicate, and contains six compartments, three in each set. Each compartment is sixty feet long, about three feet wide and four feet deep.

The sewage flows into one end of the first compartment, passes along its whole length, and at the other end passes

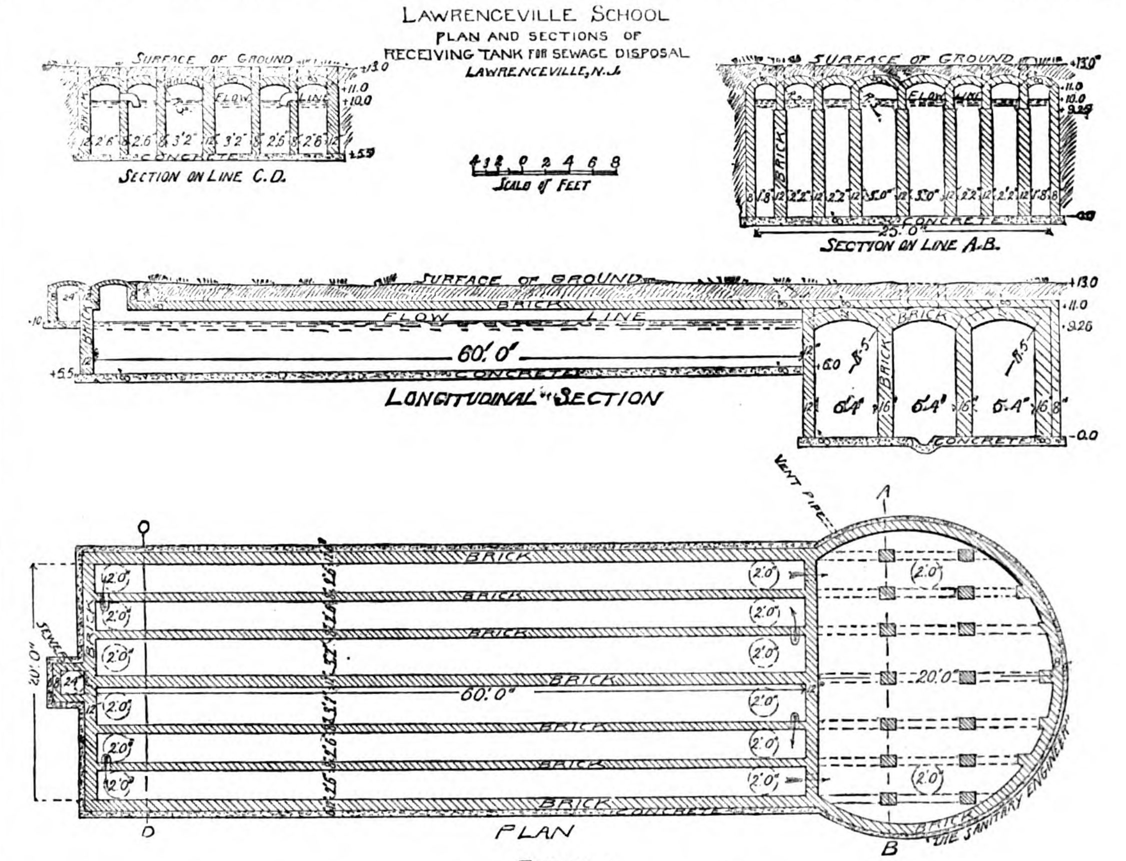


FIGURE 4.

into the second compartment through a quarter-bend pipe with the mouth turned down below the level of the outlet, to prevent scum on the surface of the liquid from passing over into the second; through the latter the liquid passes

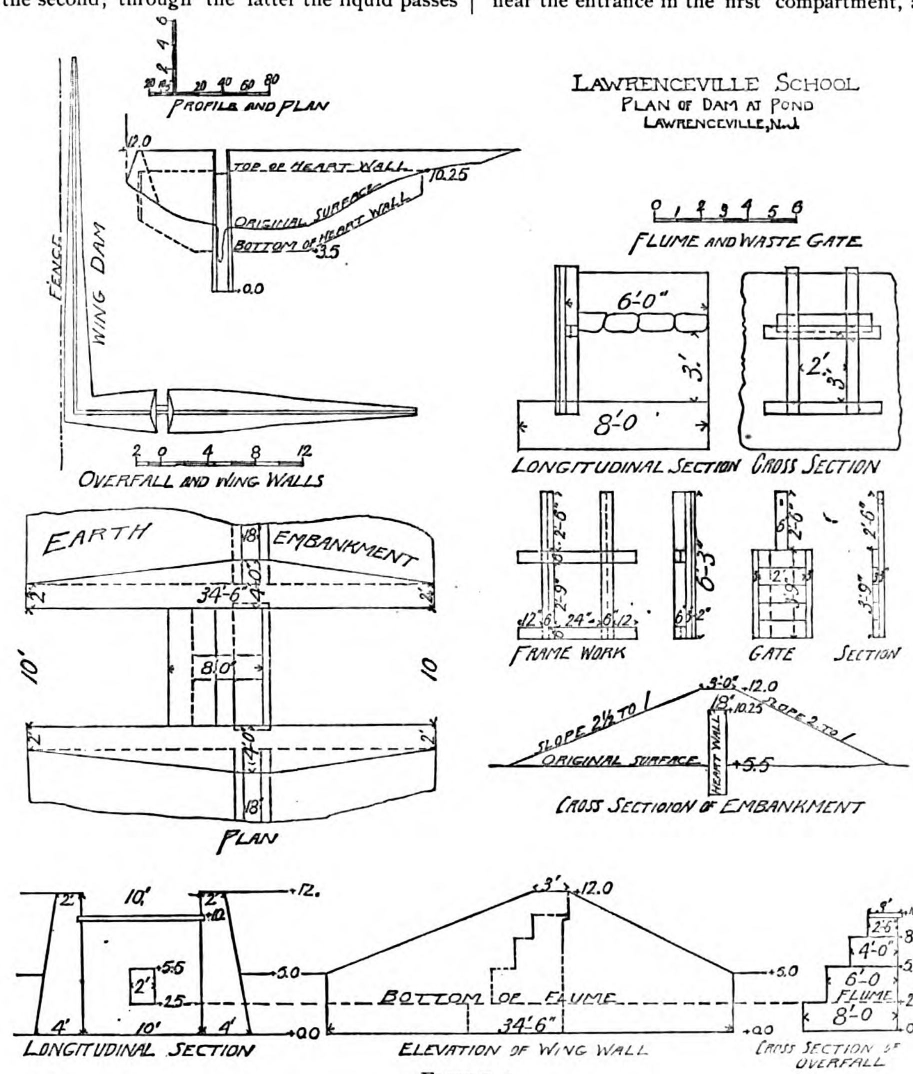


FIGURE 5.

to its further end, and in like manner into the third, at the further end of which it passes over a weir into the receiving chamber, which is circular in form, twenty-five feet in diameter and eight feet deep. From this it is pumped by a pulsometer pump as often as necessary. This chamber is ventilated by a pipe leading into the flue of the boiler-house chimney. Whenever solids collect in such quantities that the settling compartments require cleaning, the sewage is turned in the duplicate set, and the sludge removed from the first.

It is found that nearly all the solids are deposited very near the entrance in the first compartment, and to cause the deposit to be distributed more evenly over the bottom, the water in the first compartment has been syphoned into the receiving-chamber two or three times within the past six months. The rapid subsidence of the water and the

flow of incoming sewage during this operation distribute the solids over the bottom and enable the compartment to be used longer without cleaning out than would be the case if this distribution were not made.

The irrigation ground (Fig. 1) comprises about 1¾ acres in the lower part of the school grounds, between the boiler-house and the brook. It is still further limited in location by the dam and pond on the westerly side and an adjoining owner on the easterly side. It is the lowest portion of the school property, is naturally wet, and that portion near the brook (before drainage) was swampy. Its selection was a matter of necessity, it being all the land available for this purpose.

The natural surface was on a quite uniform slope from the higher portion of the brook, so that very little surface grading was necessary, but its thorough subsoil drainage became of the greatest importance.

To accomplish this, parallel lines of two-inch round agricultural tiles were laid, forty feet apart, discharging into the brook. These drains were laid four feet below the surface wherever the elevation of the brook permitted this depth; the lower part of the drains could not be placed deeper than from two to two and one-half feet, and probably the average depth is not greater than three feet. These drains were effective in drying the ground and preparing it to receive the sewage.

The distributing or subsurface tiles were laid about eight inches below the surface, in nearly parallel lines five feet apart on uniform grades of nine to twelve inches in one hundred feet.

the lower slope was afterwards made much less steep by the addition of surplus filling, which was trimmed to ogee curve and prepared by a coating of top-soil for seeding.

A masonry overflow with wing walls is provided near the centre of the dam, and a rubble masonry heart-wall laid in cement rises within the embankment to the flow-line.

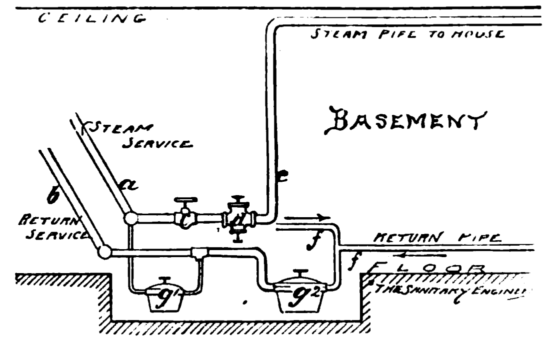
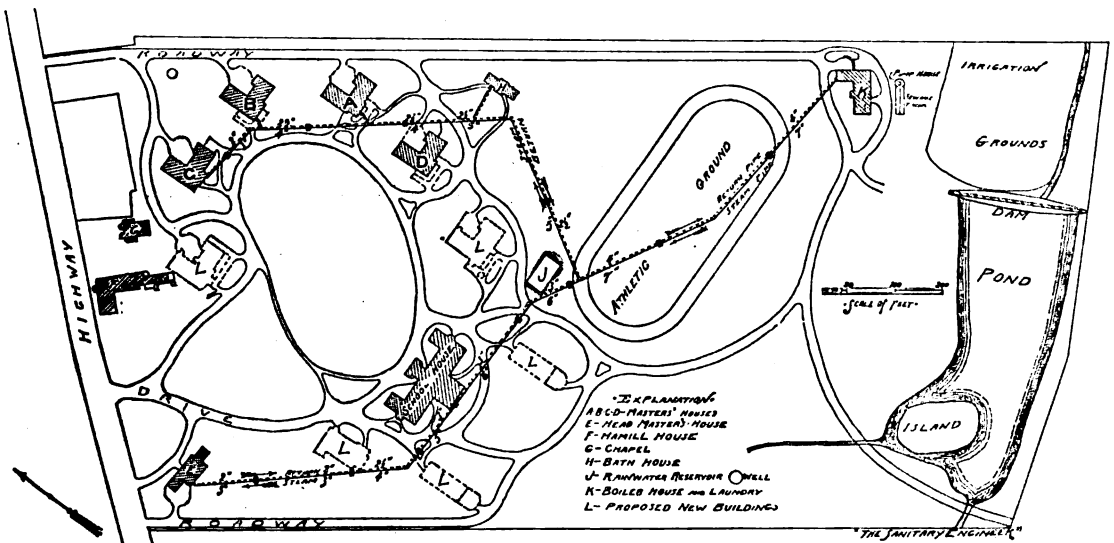


FIG. 7.

Great care was exercised in laying all pipes to true lines and grades, and in making good substantial joints in both iron and stoneware pipes.

The cost of laying the pipes was as follows. The prices given include lead and gaskets for cast-iron pipes and Portland cement and oakum gaskets for stoneware pipes, and also a profit of ten per cent.:



•PLAN OF HIGH SCHOOL GROUNDS• LAWRENCEVILLE, N.J.
SHOWING LINE OF STEAM PIPES UNDER GROUND
FIGURE 6.

They are two inches in diameter and in twelve-inch lengths, and are laid on bed-pieces of the same material and length, which cover the bottom joints. Smaller pieces cover the top joint, leaving an opening on each side of three-quarters by one-eighth inch, out of which the water escapes into the soil.

The sewage enters these lines of subsurface drains from a four-inch carrier leading from a chamber into which the pulsometer discharges and in which are the two four-inch carrier pipes leading to different parts of the ground, into either of which the sewage can be turned at pleasure and the two sections of the field used alternately.

A special branch joins the two-inch distributing tile with the four-inch carrier, the former being so attached that its bottom is at the same level as that of the carrier from which it branches, so that if but little sewage is flowing in the carrier each line of drain will get its share, those in the upper portion of the field being prevented from surcharge by either flattening the grade or throttling the first section of drain.

There are about six hundred feet of four-inch carrier pipe, and about twenty thousand feet of two-inch drains on the one and three-quarter acres of ground.

DAM AND POND.

A small pond for bathing in summer and skating and supplying ice in winter had been connected with the school for some years, and was enlarged by building a dam further down the stream, taking material for it from the excavation of the pond. (See Fig. 5.)

The dam was made of earth laid in six-inch layers, each sprinkled and rolled. The slopes are two and one-half to one on the water side and two to one on the lower, though

8-inch cast iron pipe....	22	cents per foot.	
6-inch " "	13½	"	"
4-inch " "	10	"	"
10-inch stoneware "	4½	"	"
8-inch " "	3½	"	"
6-inch " "	3	"	"

The cost of the following structures is made up from accounts kept during construction:

Water-tower (including foundation).........	$2,100
Well...............	1,000
Rain-water reservoir....	4,450
Sewage-tank	2,900
Irrigation grounds.........................	2,000

With the exception of the occasional deficiency in the capacity of the rain-water drains above mentioned, the operation of the works during the past six months has been very satisfactory.

The regular number of persons now using the water and contributing to the sewage is 180. The works are designed to accommodate 400 people.

The water supplied for all purposes averages 9,000 gallons a day. The amount of sewage-water averages 6,000 gallons a day.

This is discharged into the irrigation tile eight times in a month, or from 20,000 to 25,000 gallons at a time. The discharge from the outfall drains begins very soon after the tile are charged, showing the ground to be very porous. The brook below swarms with eels and snakes, the catching of which affords great sport to the scholars, and the vegetation on the bank of the brook is very rank.

The whole work except the water-tower was done by the contractors who erected the buildings they receiving for profit a certain percentage of the cost.

The foregoing description of the water-supply and sewerage is largely made up from a paper read before the American Society of Civil Engineers, by Frederick S. Odell, C. E., who was engineer in charge of that portion of the work.

STEAM PLANT.

The buildings are heated by steam from a common source.

Near the eastern corner of the grounds and at the lowest level, excepting the irrigating grounds, is situated a boiler-house (K, Fig. 6), adjoining which is the laundry building. The plant within the boiler-room consists of three horizontal multi-tubular boilers, each 60 inches in diameter by 16 feet long and containing eighty-four 3-inch boiler-tubes, being rated in the aggregate at 225 horse-power. They are without domes, but a 6-inch pipe rises through the brick-work at the point usually occupied by a dome. To this pipe the safety-valve is attached and a branch from it also forms the direct steam-pipe to engines, etc. The heating-pipes are taken from the shells of the boilers nearer the front; the boiler-connections being 5 inches in diameter and connecting into a cross-main 7 inches in diameter. This cross-main forms the commencement of the main distributing pipe and it is run to the point near J, Fig. 6,

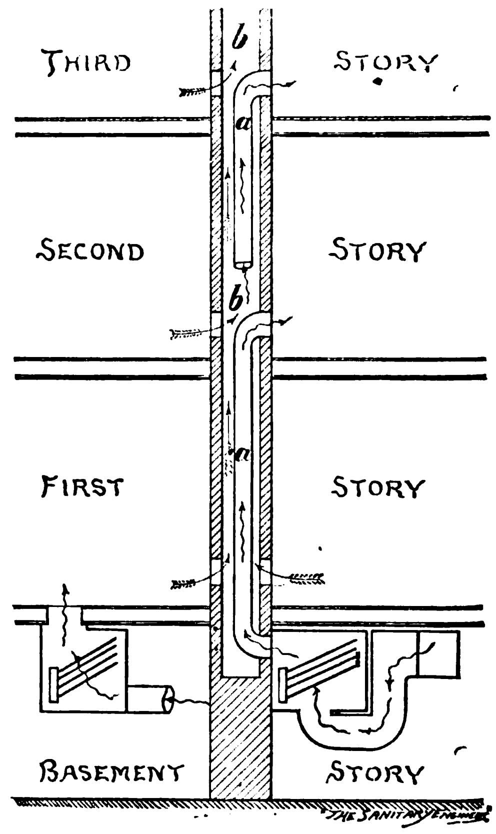


FIG. 8.

underground 7 inches in diameter. This point is called the "junction," as here the main steam service bifurcates into a 6-inch and 5-inch pipe; the 6-inch pipe continuing towards the westerly corner of the grounds and supplying steam to the Memorial Hall (school-building), and the present and proposed buildings in that direction, while the northerly branch supplies the master's houses, A, B, C, and D, and the bath-house. Reference to the plan will show the sizes of the main steam-pipe and its corresponding return pipes. The pipes are laid in brick trenches underground with a slight grade back to the boiler-house. At distances of 200 feet they are provided with the ordinary "slip" expansion-joints, a manhole being provided at each position for the purpose of examination and repacking. The pipes are covered with hair-felt and canvas in the usual manner and are supported on flat iron cross-pieces, the iron being bent edgewise to take the bottom of the pipes and the ends twisted so as to build flat within the courses of brick-work.

The original intention was to carry the steam at full boiler pressure underground to the buildings, and then reduce it within the building to any suitable pressure for distribution to the heaters by a "reducing pressure-valve."

Figure 7 shows the arrangement of the steam-service and regulating valve within the basement of a house.

In the figure *a* is the steam service-pipe, *b* the return service-pipe (condensed steam) *c* the main steam-valve *d*, the "Kieley" reducing-valve, *e* the pipe to the house-coils, etc., *f f* the return pipes, and g^1 and g^2 the "Nason" traps for the return of the water of condensation. The trap g^1 receives the water carried along with the steam in the main, and throws it into the return-pipe whether the valve *c* is closed or open, so as to establish the circulation in the service-main at all times. The trap g^2 is to take away the water condensed in the coils of the house, and throw it into the return main, thence to run by gravity to the receiving-tank in the boiler-room. The engineer found that in practice, however, he could operate the whole plant under a reduced pressure, and that it saved him much extra labor to be able to control the pressures within the houses and buildings from the boiler-room, not to take into consideration the saving by the decreased condensation in the distributing mains under the lawns and grounds. He therefore, after experimenting with his main valve as a reducer of pressure, had put into the main steam-pipe within the boiler-house one large reducing pressure regulator, and his experience is that once he expels the air from the pipes that he can run the whole plant under a pressure as low as two pounds. His range of pressures is between two and ten pounds in the mains, varying with the weather, his boiler-pressure being thirty pounds, or just what he found necessary to run the engines and pumps. The receiving-tank is fifty-four inches in diameter by twelve feet long, and the water is pumped from it, and fed into the boilers in the ordinary manner without a pump-governor.

The rooms of the buildings are warmed and ventilated by indirect radiation, direct radiation being used in the hallways. The heater used is the indirect "Bundy," with an inclination of 22 degrees to the pipes. They are inclosed in galvanized-iron cases, and take air directly through the basement-wall by passages provided by the architect. These passages or air-inlets are guarded by bronze bars, inside of which is a wire cloth of about ¼-inch mesh. The class-rooms in the school-building have each three indirect heaters, the registers of which are 16x24 inches. There are four outlet registers 16x24, two at floor and two at ceiling in each room. The heat-registers are principally in the outer walls, and the vent-registers are all in the partition-walls. The vent-flues in this building are connecte into galvanized-iron ducts in the attic, and these ducts connect with two aspirating-shafts, each 3'6"x11' in cross-section. Stacks of heating-pipes are placed in these flues near their tops for the purpose of rarefying the air. The basement-rooms are also connected with these shafts.

The residences of the masters are large and built to

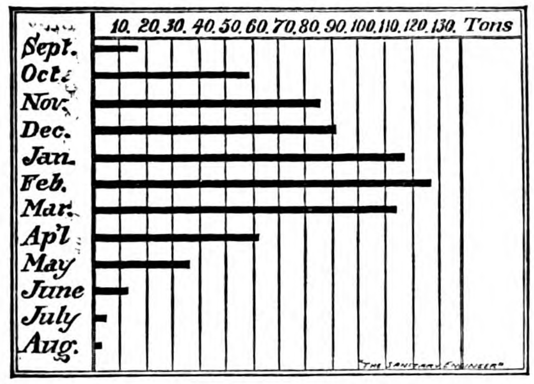


FIG. 13.

accommodate a number of the scholars as boarders and lodgers. These rooms and the master's private rooms are warmed indirectly, the method of warming being the same as for the school building. The method of extracting the air, however, is a little different. Figure 8 shows how this is accomplished. The heated-air pipes *a a* run through vent-flues *b* on their way to the floors they are to warm; some of the heat, such as can escape through the tin pipes, being utilized to rarefy the air within the vent-flues. Each house has twenty-one stacks of indirect heaters and six direct radiators. The cost of warming each house, containing about — cubic feet of air, by the system described is about $425 per year (on the assumption of $5 per ton for coal), according to the accounts kept by the general superintendent, Mr. H. H. Hamill.

The accompanying table is a detailed report of the engineer to the General Superintendent for the month of January, 1886, showing temperatures, etc., and the amount of fuel used, water pumped and sewage disposed of, a study of which will be of use to persons interested in the management of institutions. The lower part of the table shows daily averages for the months of a year.

The accompanying diagram (Fig. 13) shows graphically the coal burned per month, between September 10, 1885, and September 16, 1886; the distance between vertical and dotted lines being equivalent to each ten tons, and the horizontal black line the amount consumed.

ENGINEER'S REPORT, JANUARY 1, 1886.

Date.	Temperature. 7 o'clock A. M., deg. Fahr.	Temperature. 2 o'clock P. M., deg. Fahr.	Temperature. 7 o'clock P. M., deg. Fahr.	Steam Pressure. Boiler, lbs per sq. in.	Steam Pressure. Main.	Heating Hours. Memorial Hall.	Heating Hours. Masters' Houses.	Water Pumped. Hours.	Water Pumped. Gallons.	Laundry. Hours	Sewage Tank. Hours.	Sewage Tank. Gallons.	Coal. Received, lbs.	Coal. Consumed lbs.
January 1	38	45	30	25	3	6	24	1.40	17,900	....	....	....	16,645	4,440
2	26	42	33	25	3	5	24	....	....	....	....	....	7,665	4,810
3	37	45	45	25	3	0	24	....	....	....	....	....	....	4,810
4	51	52	54	25	3	0	24	....	....	....	3.40	25,000	3,155	4,070
5	44	44	34	25	3	0	24	....	....	....	....	....	7,495	4,440
6	30	33	21	25	4	0	24	....	....	....	....	....	....	7,030
7	17	27	30	25	7	12	24	....	....	....	....	....	9,185	6,290
8	14	26	24	25	7	12	24	1.30	15,000	....	....	....	9,360	8,880
9	20	23	13	25	8	10	24	....	....	...	3.00	18,700	....	11,100
10	12	16	11	27	20	10	24	1.20	12,000	....	....	...	....	13,690
11	11	19	13	30	20	12	24	1.30	15,700	8	....	....	....	11,840
12	0	11	0	30	20	12	24	1.20	15,000	14	....	....	....	16,280
13	*6	18	13	30	20	12	24	1.05	7,000	14	3.00	24,000	....	13,690
14	4	23	11	30	15	12	24	1.00	8,300	14	....	...	..	9,620
15	3	33	12	30	12	12	24	1.00	5,700	6	....	....	3,685	8,140
16	20	32	24	30	12	10	24	1.00	7,000	....	2.35	14,800	4,305	7,400
17	30	37	29	25	7	6	24	....	....	....	..	....	....	7,400
18	18	34	31	25	6	12	24	1.00	8,000	10	....	....	....	6,290
19	33	37	37	25	6	12	24	1.00	5,700	10	....	....	3,880	5,550
20	29	35	26	30	6	10	24	1.00	8,200	10	2.45	22,000	....	6,660
21	31	38	38	30	6	11	24	1.00	9,800	10	....	....	4,230	5,920
22	32	40	31	30	6	11	24	1.00	8,300	9	....	....	12,950	5,920
23	25	22	18	30	12	9	24	.50	7,000	....	2.00	18,000	13,285	5,920
24	11	13	12	25	18	5	24	....	....	....	....	...	....	7,400
25	17	28	29	25	15	12	24	1.20	13,000	9²	....	....	4,250	7,030
26	31	39	34	25	7	11	24	1.00	7,000	10	....	....	16,940	6,290
27	32	33	31	25	10	11	24	1.00	7,000	10	2.30	25,000	12,340	7,030
28	34	38	36	25	7	9	24	1.00	8,000	10	...	....	8,865	4,070
29	35	41	36	25	7	11	24	1.00	7,600	5	...	...	4,195	8,140
30	32	34	23	25	10	10	24	1.00	9,000	....	2.00	19,000	8,625	5,550
31	19	34	32	25	10	5	24	....	....	....	....	....	....	6,660
Total quantities	...	..	...	...	...	270	744	23.35	202,200	149²	21.30	166,500	151,055	232,360
Average per day	23.9	32.	26.4	26.7	9.4	9.	24.	....	6,522	5	....	5,371	....	7,495

DAILY AVERAGES FOR EACH MONTH FROM SEPTEMBER 10, 1885, TO JUNE FOLLOWING.

September	...	...	...	...	....	....	....	....	...	...	....	...	.	1,603
October	45.6	59.7	50.4	...	....	4.7	15.	.84	7,450	6.2	.61	5,753	4,224	3,842
November	38.	49.9	44.2	25.	5.4	6.6	22.3	1.17	11,494	6.2	.45	6,640	9,556	5,538
December	29.7	38.5	33.5	25.	6.	7.	24.	.58	8,950	5.0	.40	4,872	10,262	4,999
January	23.9	32.	26.4	26.7	9.4	9.	24.	.45	6,522	4.8	.42	5,371	4,872	7,495
February	23.4	34.5	29.6	26.7	9.	10.3	24.	.94	9,246	6.9	.68	6,357	162	9,014
March	32.2	45.	38.	25.	6.	9.3	24.	.50	8,064	7.	.40	6,000	5,200	7,297
April	46.6	60.8	53.8	25.	3.5	3.8	14.8	.36	6,083	5.1	.34	5,500	4,768	4,188
May	55.	62.	47.	...	2.3	1.8	6.7	.90	8,225	6.5	.68	6,161	2,797	2,326
June	...	...	...	...	....	....	....	.65	6,800	5.3	.64	6,300	....	455

*Below Zero.

P. M. KAFER, *Engineer*.

The cubic contents of the buildings are:

Memorial Hall	310,475 cubic feet	
Head Masters' House	44,412 " "	
Masters' House, C	107,522 " "	
" " A	105,000 " "	approx.
" " B	105,000 " "	"
" " D	105,000 " "	"
Boiler House	31,300 " "	
Laundry	....	
Bath-House	....	

The cubic contents of the laundry and bath-house were not given us, and in addition to the steam used for warming these buildings, the steam used for washing and drying, and the laundry engine must be considered.

The system, as described, is principally indirect radiation. With this *data*, therefore, close approximations of the cost of maintenance in the matter of fuel can be arrived at for similar institutions.

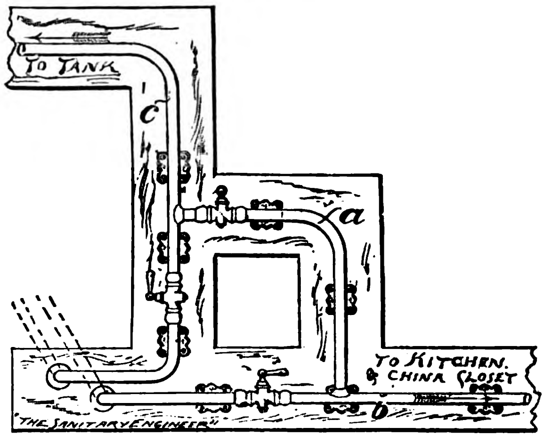


FIG. 9.

LAUNDRY BUILDING.

The laundry is intended to provide for the washing of 200 boys. It contains two "large laundry size Nonpareil" washing-machines, with power roller-wringers; one centrifugal wringer, called an "extractor," to drive more water from the clothing than can be taken out by the ordinary wringers; one small nonpareil wringer (family size) for starching collars and cuffs; one copper kettle (10 galls.), double bottom, for making starch paste, with an open-

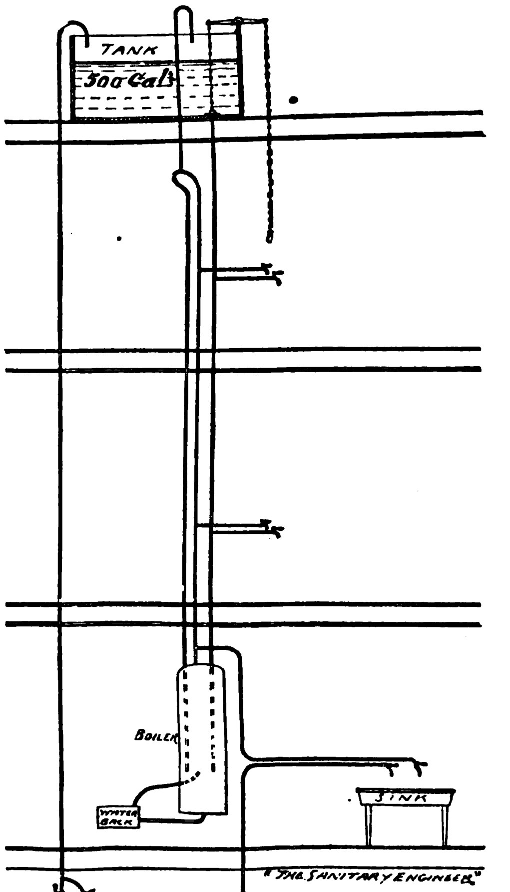


FIG 10.

butt steam-pipe inside the kettle; a tank for boiling soap chips into soft-soap, 26 inches in diameter by 30 inches high, with an open butt steam-pipe for warming; eight ordinary soapstone wash-trays, 22 inches square by 12 inches deep inside, with hot and cold water and perforated brass steam-pipe in each. Also two large wooden soaking-tubs.

The steam-heated drying-room attached has 10 clothes-racks on rollers in the usual way, 7 feet high by 10 feet long, with the ordinary dry-house coil 2 pipes high between the horses (racks). This room was vented into the space between the circular brick chimney and its outer supporting wall by 12-inch by 16-inch opening which proved too large, taking away the air so rapidly that it lowered the temperature of the room and lessened the drying power. It was then closed altogether, and, as might be expected, the moisture gathered on the beams and wood-work and fell in drops to the floor. It has now been found that an opening 4x16 inches is ample under the conditions of draught. What this would seem to prove would be that high temperatures, with a *reasonable* change of air are better than low, or comparatively low, temperatures with a rapid change for drying-rooms.

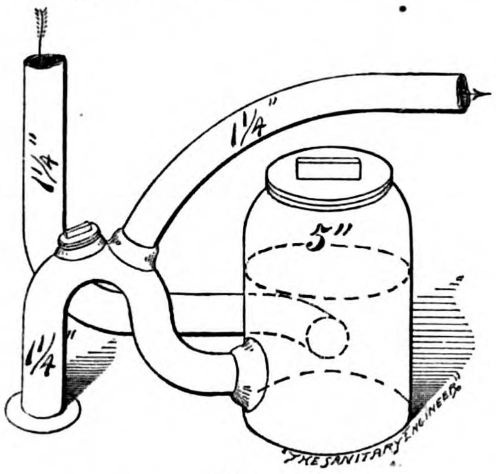


FIG. 11.

In the ironing-room is one "French" mangel of the Walworth make, and a "Gardner" collar and and cuff ironer. A "Tirrill" gas-light machine of 50-light power supplies gas for the laundry building and ironing-machine. A similar machine of 300 lights is used in Memorial Hall (school building), but as yet the question of lighting the adjacent buildings and the grounds is not decided upon.

THE PLUMBING.—BATH-HOUSE.

A bath-house shown in the block plan is provided for the use of the scholars. At present it contains eight bath-tubs and one water-closet, but it is contemplated to build another wing to it that will double its capacity. It is warmed by direct steam-heat from the general steam plant in the ground

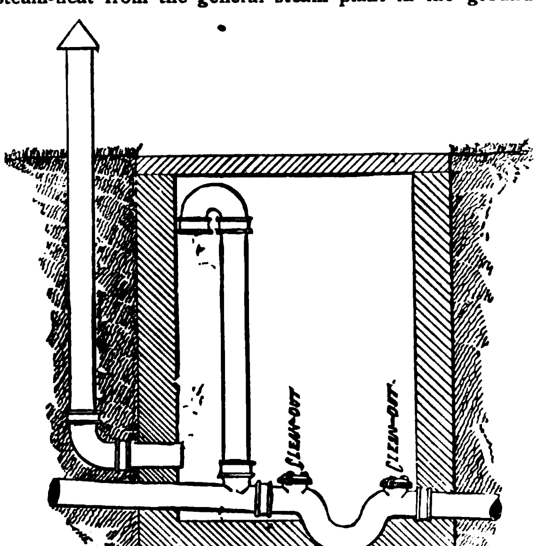


FIG. 12.

and in the basement is placed an iron cylindrical tank, within which is a brass coil for warming the water for bathing purposes. The cold water entered this tank in the usual way at the bottom and was drawn off at the top. It was found in practice that as the water was under considerable pressure, and the temperature of the steam in the coil considerable above 212° Fahrenheit, that the water became warmed at the upper side of the tank to a temperature at which much of it flew into steam when drawn at the faucets in the baths. This, presumably, would not occur if the draught of water was constant, but with intermittent use it would not do. After trying several ways to remedy the trouble the engineer transposed the pipe (inlet and outlet), so as to draw from the bottom, which remedies the evil.

The plumbing in all the buildings is of a class that would comply with the requirements of the Boards of Health of either New York or Boston. The materials are good. Extra heavy cast-iron soil and waste-pipes are used. The water-pipes are partly brass and part lead. Heavy lead connections are used under the fixtures, and the sewer-pipes are lead. Each house has two service-pipes. Figure 9 shows how they are arranged within the building; the connection and cock *a* making them interchangeable. The service *b* supplies the kitchen sink and china closet, or butler's pantry, while *c* supplies the tank from which the remainder of the house is supplied. Diagram Fig. 10 shows the principle of the arrangement of kitchen boiler, tank, and pipes. The tanks are wooden, copper lined, with brazed joints.

Figure 11 is a detail of the traps under the butler's sinks. It shows a method of venting a "Boston" trap apparently used to intercept grease. Figure 12 shows the foot-vent used to all the buildings, the object being to prevent a puff of sewer-air escaping at the cap of the foot-vent pipe above ground should the discharge of water through a vertical soil-pipe be sufficient to reverse the current of air, without at least diluting it with the air within the brick chamber. The arrangement also provides a convenient means of reaching the "clean-out" holes and bring all without the walls of the building.

Mr. Charles E. Green, nephew of the late John C. Green, and one of the residuary legatees of his will, is the active trustee of the institution, and to his energy the school is mainly indebted for the improvements here described.

The contractors for the steam-heating were Messrs. Baker, Smith & Co., of New York., and the plumbing was done by Mr. W. H. Johnson, of Boston, Mass. The contractors for the water-tower were Messrs. Tippett & Wood, of Phillipsburg, N. J. The contractors for the buildings and water-supply and sewerage were Norcross Brothers, of Boston.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

WATER-SUPPLY TO TENEMENT-HOUSES.

THE accompanying illustration shows the method adopted for supplying water to a row of tenement-houses on Ninth Avenue, corner of Ninetieth Street, New York. After the houses had been completed, it was found that the pressure in the street-main was not sufficient to force the water above the first story and that the tank system must be resorted to if the fixtures on the various floors were to be properly supplied. The buildings are "double tenements"—the hallway in the centre of the house with apartments on either side—with four three-room apartments on each floor, except the ground floors, the front halves of which are occupied by stores.

Each apartment has a sink, wash-trays, and boiler, and each floor a water-closet for the use of the tenants.

A wrought-iron tank holding 2,500 gallons and supplied by a gas-engine and pump in the cellar has been set on the roof, supported on the wall between the two inner houses and directly over the middle room of the rear apartments. From this tank are taken out two 4-inch wrought-iron pipes, each of which terminates on the wall of the top floor, in a manifold, from which, in turn, are taken four ¾-inch pipes to supply each floor separately, a ¾-inch pipe to supply the water-closets, and a 3-inch pipe to discharge into an adjoining waste-pipe to serve as a sediment-pipe. The 4-inch mains as well as each of the smaller supply-pipes have gate-valves on the top floor as shown, thus placing the supply to the four houses entirely under the control of the janitor who occupies this floor. Both the first and second floors are connected with the street-main, each supply-pipe having two stop-cocks and a check-valve, the former to allow either street or tank pressure to be used, and the latter to prevent the return of tank-water to the street-main should the valves be left open by accident. With the exception of the wrought-iron pipes about the manifold, the supply-pipes are of lead.

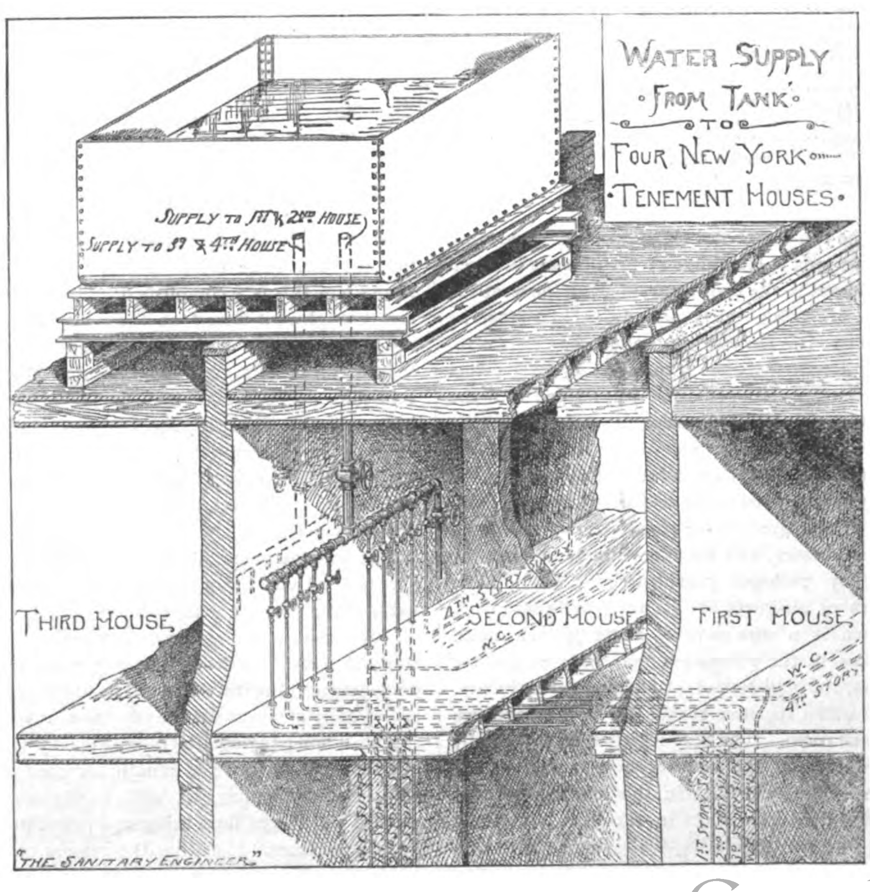
The owner is E. T. Gillender, and the plumbers Thomas Hindley & Son.

PLUMBERS' REGISTRATION NEEDED IN ST. PAUL.

A REPORTER of the St. Paul, Minn., *Pioneer Press* recently interviewed one of the master plumbers in that city on plumbing-work, and got some good advice.

The master plumber said:

"In its issue of September 23 THE SANITARY ENGINEER, accepted as an authority throughout the United States, states that professional experts have shown that a properly ventilated water-trap protects against sewer-gases, and especially against disease germs, for at least thirty hours without being changed. I have personally inspected work after there had been sickness in a house, but have never seen or heard of a case where the disease originated or was hastened in any way from sewer-gas passing through the water-seal of a properly ventilated trap. If there was a leak it was due to some of the pipes not being properly laid. Such a state of affairs is attributable to careless plumbing, which cannot be regarded as otherwise than criminal. But how can it be different when the work is not done by plumbers, for I do not call a boy who has been two years at the trade a plumber. A skin plumber always measures his man by the quantity of work he does, not the quality, and this fact explains the present situation of affairs in St. Paul. A few shops in the city do first-class work with first-class men, but the majority hire the very cheapest labor possible to execute the most important work. After they are through the inspector is called in, though not always. In case the inspector is summoned, he proceeds to use the peppermint test, which is a delusion, be-



cause it takes so long for the fumes of the peppermint to circulate through the pipe that it is next to impossible to locate a small leak in the remote portions. But were the smoke test applied a leak could be discovered, not only by the sense of smell, but also by the sense of sight, and a pressure could be exerted on the pipe, which would certainly be more than any pressure of sewer-gas and yet not enough to unseal any ordinary trap. In this way a child could discover even the smallest leak. Some jobs are done cheaply, with the intention that the inspector shall not see them. Property owners are here to blame because the inspector is not called in. Our inspector at present has all he can do in looking after the cases where he is summoned, without hunting up the others. Another city of the size of St. Paul can't be found where but one inspector is employed. But how is the public to be protected against those so-called plumbers? All journeymen plumbers should be made to pass an examination and have their names registered, just as drug clerks are required to pass an examination before they can serve in a drug store. No registered plumber will do skin work for fear of losing his license, and it will be to his interest to see that no skin work is done."

Correspondence.

A CORRECTION.

NEW HAVEN, CONN., November 22, 1886.

SIR: Please *explain* the figures given in the last number of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, page 587, on "The Effect of Sewerage on the Mortality from Typhoid Fever"; .048 per 1,000 (living) would be but one death in two years for that whole city—too small a number to draw any but very general conclusions from—even the very largest figures, .352 per 1,000, is only an average of 3⅜ deaths annually for such a city, a number phenomenally small for a European city. Are the figures correct?

Yours, etc., WILLIAM H. BREWER.

[The error indicated by Professor Brewer is due to the misplacement of the decimal point, which in each case has been carried two places too far to the left. The true figures for the old part of the city with the combined system of sewerage are 4.8 per 1,000. For the old part of the city, disposing all its excreta in privy-vaults, the mortality from typhoid for the same period was 29.2. In that part of the city without sewers the rate was 35.2, and in the vicinity of sewage irrigation 36.3.—ED.]

DISPOSAL OF GROUND-WATER FROM BUILDINGS.

TORONTO, October 23, 1886.

SIR: Among the every-day problems with which architects have to deal the disposal of ground-water is one for which it is often very difficult to find a satisfactory solution. In most cases it is necessary to provide weeping-drains to convey it off, and usually these weepers have to be connected with the sewers. Occasionally, on a hillside, for instance, they can be made to discharge on the surface of the ground without any sewer-connection, but in most city buildings this is impracticable. As pumping is usually out of the question, it is necessary that they should do their work automatically. There is in general, therefore, no alternative but to connect them with the sewers. How to do this without risk of sewage backing up through them is the problem.

In streets where there are large brick sewers it frequently happens that the basement floor is below the level of the top of the sewer. In dry weather this may be of little consequence, as the stream of sewage running in the sewer may not be deep enough to rise to the level of the branch drains entering it. But in times of flood, when the sewer is running nearly or quite full, the mouths of the branches will be covered and the sewage will back up into them. With proper plumbing and no weepers this need not necessarily be a source of much danger, as there would be no outlet for it except through the fixtures, which could be so placed as to prevent this happening. But if the weeping-drains are connected with the sewage-drain they are almost certain to be converted into distributing-tiles until the whole of the ground under the building is saturated with filth. This result may also be produced by a stoppage in the house-connection below the point at which the weepers enter it. No ordinary trap is any protection against this danger. I have tried flap-valves, apparently with success, but their action is uncertain, and when placed out of sight underground it seems unsafe to place much dependence on them.

I have no doubt it would be interesting and useful to many architects among your readers to know how others have encountered and solved this problem in the course of their practice. D. B. D.

[The difficulties of the problem are well stated in the above letter. We know of no mechanical device which will meet the case in a satisfactory manner. In other words, the conditions supposed are not satisfactory nor capable of a perfectly satisfactory solution. They presuppose incompetent or negligent municipal officers, for whose misdeeds or neglect there is no private remedy.

When a house is located on a small lot, having insufficient size to give cellar drainage within its own limits, and when the soil under the cellar bottom is not dry and porous or naturally well drained, then it behooves the municipal authorities to provide an outlet for cellar-drains that will always be free from flooding at the level where such cellar-drains discharge.

When this is done, there is no diffiulty in arranging the connection so that the water from the sewer will not back up. The safest way is to provide an entirely independent branch from the top of the sewer to receive such cellar-drainage, separate from house-drainage, and to provide a special deep trap for intercepting the sewer-air. This trap should also receive a small rain-water spout from the roof in order to prevent its seal from being lost by evaporation, for the soakage of the ground-water through the drain to the sewer may occur only at intervals of one or more years, while rains occur every month to a sufficient extent to keep a trap supplied if it has a 6-inch seal.

It has been the practice of the writer to lay a special cellar-drain pipe from several neighboring cellars, discharging into a catch-basin in the public street provided by the city authorities for street-water, entering such catch-basin below the water-line to prevent air from flowing back.

Such an arrangement has the advantage of avoiding the special trap for every house, but may not be always practicable. We agree with D. B. D. that no reliance is to be placed upon mechanical valves. In some places they may be a necessity—*e. g.*, in cities where the cellars are below tide-water—but such conditions are exceptional and not to be governed by general rules. Even there such valves are not a sure cure for trouble, but need frequent attention.

We know of no force for the removal of water from cellars so cheap and reliable as that of gravity, and we think it the duty of all municipal boards to see to it in constructing their sewers that they are put deep enough to allow every householder to avail himself of that force very day in the year. Where this is not done, the value of the real estate is impaired, or at least prevented from rising as population and commerce increases to the point which it might attain if the sewers were properly constructed.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
November 27... .. .	25.88	21.17	20.44	30.20	30.01	23.46	32.73

E. G. LOVE, Ph.D., *Gas Examiner.*

THE effort which the authorities of Dublin have been making to open negotiations with the Alliance Gas Company, of that city, with the view of purchasing the gas undertaking, has been abandoned for the present.

THE Gas-Light and Coke Company and the Peoples' Gas-Light Company, of Cleveland, O., both offer to reduce the price of gas to private consumers from $1.40 to $1.25. This offer is made to the City Council to meet the pending ordinance reducing the price of gas to $1 per 1,000 cubic feet.

MR. THOMAS FLETCHER has declined to receive the gold medal awarded to him by the Jury Committee of the Liverpool International Exhibition, on the ground that the "shameful revelations in connection with these awards" makes them valueless. He speaks of an "Exhibition agent who professes to assist in obtaining gold and silver medals for a consideration in money."

CONSTANTINOPLE has at present a water-supply from Lake Dercos, twenty miles from the city. This was introduced by a French company, and was intended to supplant or supplement the supply, which the city had had for years, from an open reservoir six miles distant, in which the rain collected, and from which it was brought in iron pipes.—*Gas and Water Review.*

A COMMITTEE of the Metropolitan Board of Works of London, have been considering the subject of overhead telephone and telegraph wires, and whether any future legislation in this direction was necessary. They presented the following resolution, which was adopted by the Board: "That a communication be addressed to her Majesty's Government calling attention to the danger likely to arise from the increasing number of overhead telegraph and telephone wires, and suggesting that such wires should be placed under proper supervision, as recommended by the Select Committee of the House of Commons in the year 1885."

THE report of the Western Union Telegraph Company, for the year ending June 30, shows that the company operates 489,607 miles of wire, and has 15,142 offices. During the year 43,289,807 messages were sent, and the profits of the company for that period amounted to $3,919,855.

PROF. PLYMPTON, who is a member of the Brooklyn Underground Wire Commission, and who visited Europe recently to ascertain what has been done there in the way of "burying wires," reports that as yet no results have been reached by foreign engineers. The *Electrician*, of London, in commenting on the report says "that the necessity for burying the wires has become urgent in America at an earlier date than it has in this country (England), not merely from the more general use of the telephone, but also from the fact that the use of street-pole lines was at first tolerated in the States, whereas all our overhead lines in cities are also over house."

THE NEW SURGEON-GENERAL OF THE ARMY.

ON November 18 the President appointed Dr. John Moore to be Surgeon-General of the Army, thus filling the vacancy created by the retirement of Dr. Murray, in August last. Dr. Moore was born in Indiana, entered the army as Assistant Surgeon in 1853, and served in Florida and in the Utah expedition in 1857. In June, 1862, he became full Surgeon, and was Medical Director of the Fifth Corps of the Army of the Potomac. Subsequently he was Medical Director of the Army of the Tennessee, and with General Sherman on his march to the sea. He was promoted to be Assistant Medical Purveyor, with the rank of Lieutenant-Colonel, in 1883, and at the time of his appointment was on duty in San Francisco. His selection meets with general approval.

TORONTO PLUMBING LAW.

THE Local Board of Health has had a by-law under consideration to regulate the licensing of plumbers. At its meeting on the 25th ult., it adopted unanimously the amendments proposed by the Sanitary Association and the Master Plumbers' Association. A strong expression of opinion was given that it is desirable to have a by-law regulating the construction of buildings.

HOT WATER AND THE APPETITE.

IT is a specialty of sanitary reformers, who are among the most useful of the many intellectual nuisances in the world, to be deficient in the quality of humor. One of them, some years ago, recommended that a man's dead relatives should be burned at the corners of streets, to save gas-lamps; another, not two years ago, lectured on the unhealthiness of boots in bedrooms, and Mr. Mansergh, at the close of a most sensible address to the Sanitary Congress on water-supply, brought in his views on teetotalism in the oddest way. He told his audience that "systematic hot-water drinking had been proved in America to be destructive of the appetite for alcohol." We entirely believe him, and if he extended the destructive effect to the appetite for mutton chops, fruit, or wheaten bread, we should believe him also. But why limit us to hot water, when tartar emetic, ipecacuanha, unrefined cod-liver oil, and perhaps twenty other drugs would be at least equally potent? The old remedy of Rechab, total abstinence, is an easier one than that, and as perfectly effective as long as it is pursued. The difficulty of the temperate is not to leave off alcohol, but to believe in the use of leaving it off. They do not find that the most perfect abstainers in the world, life convicts, become better people.—*London Spectator.*

TABLES FOR THE ECONOMICAL CONSUMPTION OF FOOD.

THE following are the tables referred to in an editorial elsewhere. We print them as suggesting the possibilities of greater economy, though we are not prepared, as we said before, to accept their entire practicability.

Daily Rations Computed to Furnish Nutrients Equivalent to those of Standard for Laboring Man at Moderate Work.—Standard Ration: Protein (118 grams) 0.26 lb.; Fats (56 grams) 0.12 lb.; Carbohydrates (500 grams) 1.10 lbs.

A.—DAILY RATIONS COSTING 12 CENTS OR LESS.

FOOD MATERIALS.

Kinds.	Amts.	Costs
No. 1.		
Beef, neck	½ lb.	4 cts.
Beans	¼ "	¾ "
Potatoes	2 "	2 "
Oatmeal	¼ "	1¼ "
Butter	¾ oz.	1½ "
Rye flour	½ lb.	1¼ "
Total		10¾ "
No. 2.		
Beef, shin	½ lb.	3 cts.
Oatmeal	½ "	2½ "
Cornmeal	½ "	1 "
Milk, ½ pint	½ "	2 "
Potatoes	1 "	1 "
Butter	1 oz.	2 "
Total		11½ "
No. 3.		
Herring	½ lb.	3 cts.
Oatmeal	¼ "	1¼ "
Potatoes	1 "	1 "
Wheat flour	1 "	4 "
Butter	1/16 "	2 "
Total		11¼ "
No. 4.		
Beef, shin	½ lb.	3 cts.
Potatoes	3 "	3 "
Wheat flour	½ "	2 "
Beans	⅛ "	¾ "
Butter	1/16 "	2 "
Sugar	1½ oz.	1 "
Total		11¾ "

FOOD MATERIALS.

Kinds.	Amts.	Costs.
No. 5.		
Alewives	1 lb.	3 cts.
Potatoes	2 "	2 "
Cornmeal	½ "	1½ "
Wheat flour	½ "	2 "
Butter	1/16 "	2 "
Total		10½ "
No. 6.		
Smoked Herring	½ lb.	3 cts.
Potatoes	1 "	1 "
Beans	¼ "	1½ "
Wheat flour	1 "	4 "
Butter	1/16 "	2 "
Total		11½ "
No. 7		
Beef, neck	½ lb.	4 cts.
Beef, shin	½ "	3 "
Alewives	1 "	3 "
Beans	¼ "	¾ "
Milk, ½ pint	½ "	2 "
Rye flour	½ "	1¼ "
Wheat flour	½ "	2 "
Oatmeal	¾ "	3¾ "
Cornmeal	1 "	3 "
Potatoes	5 "	5 "
Butter	2¾ oz.	5½ "
Total, for 3 men		33¼ "
" " 1 man		11 "
No. 8.		
Beef, neck	½ lb.	4 cts.
Beef, shin	½ "	3 "
Rye flour	½ "	1¼ "
Sugar	1½ oz.	1 "
Oatmeal	½ lb.	2½ "
Herring	1 "	6 "
Beans	10 oz.	2⅝ "
Wheat flour	2½ lb.	10 "
Potatoes	7 "	7 "
Butter	3¾ oz.	7¼ "
Total for 4 men		44⅝ "
" " 1 man		11⅞ "

B.—DAILY RATIONS COSTING FROM 12 TO 15 CENTS.

FOOD MATERIALS.

Kinds.	Amts.	Costs.
No. 9.		
Liver	½ lb.	5 cts.
Potatoes	1 "	1 "
Butter	1/16 "	2 "
Cornmeal	1 "	3 "
Bread	½ "	3 "
Total		14 "
No. 10.		
Beef, shin	¼ lb.	3 cts.
Bread	½ "	2½ "
Potatoes	1 "	1 "
Oatmeal	¼ "	1¼ "
Cornmeal	½ "	1½ "
Butter	1/16 "	1 "
Sugar	1/32 "	¼ "
Milk	¼ "	2 "
Total		13½ c.
No. 11.		
Salt cod	½ lb.	3½ c.
Oatmeal	½ "	2½ "
Cornmeal	½ "	1 "
Milk	½ "	2 "
Butter	1 oz.	2 "
Potatoes	2 lbs.	2 "
Total		13 c.
No. 12.		
Pork	⅛ lb.	2 cts
Beans	¼ "	1¼ "
Salt cod	¼ "	2 "
Potatoes	1½ "	1½ "
Bread	1¼ "	6 "
Total		12¾ c.
No. 13.		
Salt codfish	½ lb.	3½ c.
Salt pork	⅛ "	2 "
Crackers (pilot)	1 "	5½ "
Peas	½ "	3 "
Total		14 c.

FOOD MATERIALS.

Kinds.	Amts.	Costs.
No. 14.		
Fresh mackerel	¾ lb.	4½ c.
Potatoes	1 "	1 "
Cracked wheat	½ "	3 "
Cornmeal	½ "	1½ "
Beans	¼ "	¾ "
Butter	1 oz.	2 "
Total		12¾ c.
No. 15.		
Beef, neck	½ lb.	4 cts.
Potatoes	1 "	1 "
Cornmeal	½ "	1½ "
Rye bread	1 "	4 "
Butter	1 "	2 "
Total		12½ c.
No. 16, for 3 men.		
Liver	½ lb.	5 cts.
Beef, shin (soup)	½ "	3 "
Salt codfish	½ "	3½ "
Salt pork	2 oz.	2 "
Crackers (pilot)	1 lb.	5½ "
Peas	½ "	3 "
Sugar	½ oz.	¼ "
Milk	¼ lb.	2 "
Oatmeal	¼ "	1¼ "
Potatoes	2 "	2 "
Bread	1 "	6 "
Butter	2 oz.	4 "
Cornmeal	1½ lb.	4½ "
Total, for 3 men.		42 cts.
" " 1 man.		14 "
No. 17, for 4 men.		
Beef, shin	½ lb.	3 cts.
Fresh mackerel	¾ "	4½ "
Salt cod	¾ "	5½ "
Pork	2 oz.	2 "
Beans	½ lb.	1½ "
Wheat bread	1¾ "	8½ "
Cracked wheat	½ "	3 "
Cornmeal	1½ "	4½ "
Oatmeal	¾ "	4 "
Butter	3 oz.	6 "
Milk	¾ lb.	4 "
Potatoes	5½ "	5½ "
Sugar	½ oz.	¼ "
Total, for 4 men.		52¼ c.
" " 1 man.		13 "

C.—DAILY RATIONS COSTING FROM 15 TO 20 CENTS.

FOOD MATERIALS.

Kinds.	Amts.	Costs.
No. 18.		
Beef, neck	¼ lb.	2 cts.
Salt cod	¼ "	1½ "
Potatoes	1 "	1 "
Bread	½ "	3 "
Cabbage	2 oz.	¼ "
Turnips	2 "	⅛ "
Carrots	2 "	⅛ "
Oatmeal	2 "	⅝ "
Milk, 1 pint	1 lb.	3½ "
Rice	2 oz	1⅛ "
Sugar	2 "	1¼ "
Cornmeal	¼ lb.	¾ "
Soda crackers	1 oz.	¾ "
Butter	1 "	2 "
Total		18 "
No. 19.		
Round steak	½ lb.	8 cts.
Milk	½ "	2 "
Butter	1 oz.	2 "
Cheese	1 "	1 "
Bread	½ lb.	2½ "
Potatoes	1½ "	1½ "
Sugar	1½ oz.	1 "
Turnips	½ lb.	½ "
Cornmeal	⅛ "	1 "
Total		19½ "
No. 20.		
Beef, shin	¼ lb.	1½ cts
Fresh cod	½ "	4 "
Oatmeal	⅛ "	½ "
Bread	½ "	3 "
Butter	1 oz.	2 "
Potatoes	1 lb.	1 "
Boston crackers	2 oz.	1¼ "
Milk, ½ pint	½ lb.	1½ "
Cornmeal	½ "	1½ "
Total		16¼ "
No. 21.		
Beef, neck	½ lb.	4½ cts
Milk	½ "	2 "
Cheese	1 oz.	1 "
Bread	1 lb.	5 "
Potatoes	2 "	2 "
Sugar	1½ oz.	1 "
Total		15½ "

FOOD MATERIALS.

Kinds.	Amts.	Costs.
No. 22.		
Pork	½ oz.	½ cts
Beans	3 "	2 "
Fresh cod	½ lb.	3½ "
Potatoes	1½ "	1½ "
Rye bread	1 "	4 "
Butter	1 oz.	2 "
Sugar	2 "	1½ "
Milk	1 lb.	3½ "
Total		18½ "
No. 23, for 3 men.		
Round steak	½ lb.	9 cts.
Beef, neck	¼ "	2 "
Fresh haddock	½ "	3½ "
Salt cod	¼ "	1½ "
Fat pork	½ oz.	½ "
Beans	3 "	2 "
Milk	2½ lb.	9 "
Cheese	1 oz.	1 "
Butter	3 "	6 "
Wheat bread	1 lb.	5 "
Rye bread	1 "	4 "
Soda crackers	1 oz.	¾ "
Oatmeal	2 "	⅝ "
Cornmeal	7/12 lb.	1¾ "
Rice	2 oz.	1⅛ "
Carrots	2 "	⅛ "
Turnips	10 "	⅝ "
Potatoes	4 lbs	4 "
Cabbage	2 oz.	¼ "
Sugar	5½ "	3½ "
Total for 3 men.		46¼ "
" 1 man.		15 "
No. 24, for 3 men.		
Round steak	½ lb.	9 cts.
Beef, shin (soup)	¼ "	1½ "
Fat pork	1 oz.	1 "
Fresh cod	½ lb.	4 "
Cheese	1 oz.	1 "
Milk	1 lb.	3½ "
Beans	½ "	5 "
Peas	¼ "	2½ "
Wheat bread	1½ "	7½ "
Rye bread	½ "	2 "
Boston crackers	2 oz.	1¼ "
Oatmeal	2 "	½ "
Cornmeal	⅝ lb.	2½ "
Potatoes	2½ "	2½ "
Turnips	½ "	½ "
Butter	3 oz.	6 "
Sugar	3½ "	2¼ "
Total for 3 men.		53½ "
" 1 man.		18 "

CINCINNATI PAVEMENTS.

(Special Correspondence.)

CINCINNATI, November 27, 1886.

ABOUT $2,000,000 will be spent on paving the streets of Cincinnati during 1887, with either granite blocks or asphalt. About one mile and a half of one street has been laid in asphalt, while several miles have been laid in granite blocks. The latter is deemed best for heavy hauling, but the former shows no sign of wear, although put down last summer and since then subjected to the severest test, as, owing to its smoothness, all sorts of vehicles have crowded upon it. Citizens living on streets yet to be paved are petitioning for asphalt instead of granite blocks. If the same care is taken with laying the streets next year as was this, Cincinnati will have the smoothest roadways of any city in the United States.

The success of the cable railroad over the long, hilly, and tortuous route of the Walnut Hills Street Railway in Cincinnati has created a demand for this kind of rapid transit, that already two other long lines are under contract, while several more are projected.

A NEW dam near Columbia, S. C., recently constructed for the Langley Cotton Mills, gave way November 29, doing much damage to the track of the Charlotte, Columbia, and Augusta Railroad. The break is attributed by the people of the vicinity to an earthquake shock which was felt the night before.

THE Water Department of Milwaukee, Wis., is busily engaged with a force of night-inspectors who take a water-phone, and between the hours of 10 P. M. and 3 A. M. systematically visit the stop-cocks at the curb of the water consumers, testing for leaks.

ON THE DESTRUCTION OF NIGHT-SOIL AND GARBAGE BY FIRE.*

EXPERIMENTS AT WHEELING, W. VA.

TO PROVIDE an efficient way of disposing of the night-soil and garbage of cities and large towns has been a subject of much thought on the part of sanitarians for many years. Convinced that special contagious and infectious diseases are propagated and that many diseases are disseminated by pollution of the air and drinking-water, their energies have been directed to the providing of a plan for thoroughly protecting cities from the dangers resulting therefrom. With others our health authorities for several years have been trying to devise a plan for so disposing of these substances as to protect our own people as well as the citizens of Bellaire, O.

To make this understood, and, at the same time, furnish an example of the folly of claiming, as some do, that a running stream of water will purify itself in a few score feet, let us here give the relative situation of the two cities. Wheeling is located on a narrow plain on the east side of the Ohio River, in West Virginia. This plain is bounded in the east by high hills and on the west by the river. The city extends along the river for five miles. Opposite the extreme southern end of Wheeling, on the west side of the river, is the north end of Bellaire, and that city extends for two miles down the river. About one-half mile from the north end of Bellaire her water-works are located on the river bank, and the supply-pipe extends out into the river one hundred feet from the shore at low-water mark. The current in the river is deflected by a bend commencing a short distance above the southern end of our city toward the Ohio or Bellaire shore, and substances thrown into the river at Forty-eighth Street (our last street south) are carried over toward the Bellaire side. Especially is this the case during low water in summer. By one of our ordinances, night-soil men are required to haul all night-soil to Forty-eighth Street, and, after driving as far as possible out into the river, empty the contents of their carts and barrels. The garbage collectors also empty their garbage into the river at various places along the river front. From these two practices it results that the drinking-water of Bellaire is fearfully polluted, and that city is made a hot-bed of disease. In fact, she has the reputation of being the most unhealthy place in eastern Ohio. For how much of this our city is responsible it is fearful to think, but that a great part of it is due to our way of disposing of our city's refuse matters there can be no doubt.

The furnishing of night-soil to gardeners as a fertilizer has been tried; also the giving of the garbage to dairymen. These plans have resulted in polluted wells and diseased cows. The loading of boats and towing them down below Bellaire has been suggested and created so great dissatisfaction in other towns situated further down the river that it had to be abandoned. Determined to relieve our own city of some of the causes of preventable diseases which were too prevalent among our people, and at the same time relieve her of the injustice she was almost daily doing her neighbor below, our Health Department during the past summer made a series of experiments in the destruction of night-soil and garbage by fire, and we claim that at last we have secured a means of entirely destroying these substances and their power to do evil. The experiments had to be made between late bed-time and morning, as a great prejudice existed in the people's mind to having night-soil burned near their residences. Two facts about the burning of night-soil especially impressed us. One was that the odor was not such a one as we all naturally think it would be. It was something near to the smell of burnt leather. Another was the intense heat required to burn it.

The first experiments were made in a bench of five retorts at our city gas-works. The night-soil was mixed with fifty per cent. of fine slack and three retorts charged with this mixture. The other two retorts were charged with a mixture of equal parts of night-soil and "breeze" (fine coke siftings). The reason for adding these substances was to divide the night-soil and provide an inflammable substance within its mass to assist in burning it. The retorts were charged at 11 P. M., and it was not until 7 A. M. next morning that the contents were reduced to a fine odorless powder. On another evening three retorts were charged with a mixture of twenty per cent. of fine coke and eighty of night-soil, and two with night-soil alone. The result was the same as before with the mixed charge. Nine hours were required to burn the unmixed. Convinced that the retorts were not the proper things for successful combustion of this substance, owing to the want of a full supply of oxygen, it was determined to find a furnace with a strong draught capable of producing a greater heat than could be obtained in the retorts. Fortunately a change made shortly before this time in the process of making nails in our mills provided what was desired. The change from the iron to the steel nail had dispensed with the boiling-furnace, and on application being made to Mr.

* A paper by Dr. George Baird, Health Officer of Wheeling, W. Va., read at the Toronto Meeting of the American Public Health Association.

Reister, manager of one of our iron mills, for the use of one of their furnaces the privilege was cheerfully granted, and by his order it was prepared for the third experiment. After twenty-four hours' heating a charge of twenty per cent. fine slack and eighty per cent. night-soil was made, and it was burned in one hour and twenty minutes. A second charge of "breeze" and night-soil was made, and it was burned in a little more than an hour. A third charge of night-soil alone was made, and it was burned in about the same time as the first charge.

Another change in the mill arising from the introduction of the steel nail was the building of a Smith gas-furnace for the heating of the steel slabs preparatory to being rolled into nail plate. This furnace is much larger than the boiling-furnace and capable of generating a more *intense heat* than any furnace known. Application was *made for the* use of one of these furnaces and it was kindly granted. The result of this experiment was as follows: A barrel of ordinary garbage or slop was burned in four minutes; a barrel of butchers' offal (bones and animal matter) was burned in seven minutes; a barrel of fluid night-soil, thrown into the furnace with buckets, was almost instantly vaporized, and a barrel of solid fæces was burned in fifteen minutes.

Convinced that the furnace had every requisite for fulfilling the design of destroying night-soil and garbage, the Committee on Health reported the result of the above experiments to council, and recommended the making of a contract with Mr. Smith for the building of a furnace capable of destroying daily sixty tons of night-soil and garbage, and also for burning dead animals of all kinds which might die within the city limits, as well as the refuse matter from our butcher shops. This furnace is to be constructed for using natural-gas as a fuel.

Of its success there can be no doubt. The heating capacity of natural-gas is more than four times greater than that of coal. With coal we destroyed night-soil in a boiling-furnace in one and a quarter hours; with artificial gas, generated from fine slack, we burned it in fifteen minutes; with natural-gas we can do still better. Notwithstanding the great difficulty in destroying this substance by fire, there is in the use of natural-gas as a fuel more risk of destroying the furnace than of not entirely consuming the night-soil.

It must not be understood that this furnace can only be used in cities and towns where *natural* gas has been introduced as a fuel. Mr. Smith has gas-generators built with his furnace in cities where there is no natural-gas, and claims that he can "produce a heat of greater capacity and with more economy than by any other method or from any other source outside of natural-gas, and as cheap as natural-gas can be supplied by a private company." The fine coal or slack is not the only substance from which artificial gas can be generated. Tan-bark, peat, and many other substitutes can be used.

It is much regretted by us that this furnace will not be completed before the meeting of the Public Health Association in October. It would be a great satisfaction to be able to report its successful workings to that body. Mr. Smith's faith in its success is so strong that he has agreed with our city to ask no compensation until, by a series of successful experiments, he has shown its capacity to destroy all substances proper to be offered as tests of its powers.

Should any member of the Public Health Association feel sufficient interest in the subject of the destruction of city refuse by fire as to wish to obtain more information in reference to the Smith furnace, if he will address M. F. Smith, M. E., Bissell's Block, Pittsburg, Pa., he will be furnished full details. Mr. Smith being the inventor and patentee of the furnace we do not feel at liberty to attempt a description of his furnace, and have only tried to furnish proof of its capacity to solve a long-tried problem in the government of our cities and large towns.

ERASTUS BROOKS.

ERASTUS BROOKS, for forty years a New York journalist, and for the latter part of his life active in sanitary affairs in this State, died in West New Brighton, Staten Island, on Thanksgiving Day, in the seventy-second year of his age. Mr. Brooks entered journalism in Haverhill, Mass., and Portland, Me., and then became connected with the New York *Express*, started by his brother, James Brooks, in 1836. He was soon associated in the editorial management with his brother, who died in 1873. Erastus Brooks continued in the editorial control of the journal until 1877, when it passed into the hands of Mr. John Kelly and his associations, to be later merged with the *Mail*, and pass into the control of its present management.

On the organization of the State Board of Health of New York, in 1880, Mr. Brooks was appointed a member, and thereafter took an active interest in all health matters. This community and the cause of public health is indebted to Mr. Brooks for earnest and influential work in favor of legislation that, at the time it was pending, needed the support of legislators of experience and high character. Notably the Tenement-House Law, the Plumbing Law, the Food Adulteration Law, and other measures intended to strengthen the hands and facilitate the labors of the New York health authorities. From personal experience of the writer, we can say that many a favorable vote for these measures was secured from men who had not the time to investigate them, but who trusted to Mr. Brooks' endorsement as that of a man conservative, honest, able, and public-spirited.

WALTON WHITE EVANS.

WALTON WHITE EVANS, a widely-known civil engineer, died in this city November 28, in his seventy-first year. Mr. Evans was the oldest living graduate, with one exception, of the Polytechnic Institute, at Troy, N. Y. His first connection with railroad engineering was on the Harlem Railroad. His successive railroad enterprises giving him much celebrity, the Chilian Government invited him thither and made him Chief Engineer under that Republic. He built the important lines of railway in Chili, also several lines in other South American countries, and designed and superintended the erection of many public buildings. From Chili he went, at the invitation of the Government of South Australia, to that country, and carried out works similar to those which had engaged him in Chili. He also spent some time in engineering works in New Zealand. Latterly, withdrawing from active practice, he became a close student and writer on engineering subjects. In this work he carried on a wide correspondence on many topics.

Mr. Evans was a member of the American Society of Civil Engineers, of the British Institution of Civil Engineers, and of the Council of the American Geographical Society.

DR. JOHN P. GRAY.

DR. GRAY, Superintendent of the New York State Asylum for the Insane at Utica, died November 29. Some four-and-a-half years ago Dr. Gray was shot by an insane man, and, although he apparently recovered his health, it is believed the shock hastened his death. Dr. Gray was appointed an assistant physician in the asylum in 1851; made acting-superintendent in 1853, and was the manager of the asylum from that time till his death. He held a high place as a specialist on insanity. At his death he was 61 years old.

PERSONAL.

WILLIAM PAUL GERHARD, C. E., retires from the editorship of *Building* after this week, resuming his profession of consulting engineer for sanitary work.

DANA C. BARBER, C. E., for some time on the staff of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, and more recently connected with surveys conducted by Rudolph Hering, C. E., for the Water Department of Philadelphia, to determine existing sources of pollution and new sources of water-supply, has now entered upon the practice of his profession in Philadelphia as a consulting sanitary engineer.

WILLIAM WOODCOCK, Master Mechanic of the Central Railroad of New Jersey, and President of the American Railway Master Mechanics' Association, died at his home, in Elizabethport, N. J., November 27.

MR. HAMILTON SMITH, JR., the author of a recent valuable work on hydraulics and of several papers read before the American Society of Civil Engineers, was married November 8 in London to Mrs. Alice Jennings Congreve, of New Orleans, La.

MR. ELIOT C. CLARKE, of Boston, who has recently been the Chief Engineer of the Massachusetts Drainage Commission, and who was connected with the Boston Main Drainage-Works as Principal Assistant Engineer-in-charge, has been elected Treasurer of Boott Cotton Mills, of Lowell, Mass.

As WE go to press we learn the death of Martin Coryell, since 1867 a member of the American Society of Civil Engineers.

JAMES STEWART, of Lancaster, Pa., railroad contractor, died at Oregon, Wis., November 28.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE seventh annual and fourteenth regular meeting assembled in the hall of the New York Academy of Medicine, Monday evening, November 29. The officers-elect are: President, George H. Babcock, of New York City; Vice-Presidents, Joseph Morgan, Jr., of Johnstown, Pa.; Charles T. Porter, of New York City; Horace S. Smith, of Joliet, Ill.; Secretary, F. R. Hutton, of New York City; Treasurer, William H. Wiley, of New York; Managers, Frederick G. Coggin, of Lake Linden, Mich.; John T. Hawkins, of Taunton, Mass., and Thomas R. Morgan, of Alliance, O.

A full report of the proceedings will be published in our next issue.

AMERICAN INSTITUTE OF ARCHITECTS.

THE twentieth annual convention began at the Mutual Life Insurance Company's Building in this city last Wednesday forenoon—Mr. Thomas U. Walter, of Philadelphia, President of the Institute, delivering the address of welcome. The proceedings, which the large number of special articles in this issue prevent our reporting this week, will be noticed at length in the next issue.

Patents.

352,620. Manufacture of Gas From Crude Petroleum. Frederick C. Kniese, Baltimore, Md., assignor of two-thirds to Alexander Ross, same place, and H. F. Attrill, Goderich, Canada. Filed June 25, 1886. Issued November 16, 1886.

352,628. Water-Heater. William E. Nolan, Brooklyn, N. Y. Filed June 26, 1886. Issued November 16, 1886.

352,630. Boiler-Water Purifier. Edward A. Russell, Milwaukee, Wis., assignor of two-thirds to Henry J. Delaney and Robert Giljohan, both of same place. Filed March 23, 1886. Issued November 16, 1886.

352,638. Water Heater and Purifier. Martin M. Wilson, Honey Grove, Tex. Filed March 24, 1886. Issued November 16, 1886

352,643. Valve for Water-Closets. John Demarest, New York, N. Y., assignor to the J. L. Mott Iron-Works, same place. Filed June 14, 1886. Issued November 16, 1886.

352,644. Filter. William Foulkes and William E. Foulkes, Morrisania, N. Y. Filed June 1, 1886. Issued November 16, 1886.

352,663. Process of Burning Gas. Leman P. Rider, Pittsburg Pa. Filed March 24, 1886. Issued November 16, 1886.

352,706. Storage-Battery. Otto A. Moses, New York, N. Y. Filed January 18, 1886. Issued November 16, 1886.

352,724. Tube-Clamp for Oil-Wells, Etc. Willet C. Wells, Tiffin, O. Filed March 22, 1886. Issued November 16, 1886.

352,732. Hydraulic Nozzle and Gate. James H. Byrne, Nevada City, Cal., assignor of one-half to Henry S. Welch, same place. Filed November 23, 1885. Issued November 16, 1886.

352,747 Water-Closet. Harry L. Goodwin, New York, N. Y. Filed July 8, 1886. Issued November 16, 1886.

352,777. Gas-Lamp. Bruno E. Panzig, Philadelphia, Pa. Filed May 8, 1886. Issued November 16, 1886.

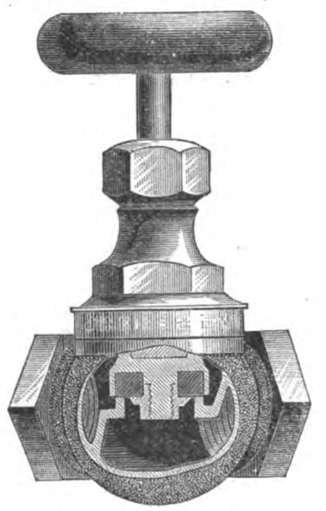
352,825. Steam-Boiler. Charles N. Hitchcock, Stockton, Cal. Filed March 29, 1886. Issued November 16, 1886.

Steam and Hot-Water Heating.

THE DAVIS STANDARD AUTOMATIC AIR-VALVE is used by all leading steam-fitters in the United States and Europe, for direct and indirect radiators. All first-class jobbers keep them. HAY & PRENTICE CO., Manufacturers, CHICAGO.

Radiator Valves.

(RENEWABLE DISCS.)



CORNER VALVE.

Steam-Heating Specialties,

IRON PIPE, FITTINGS, AND BRASS GOODS,

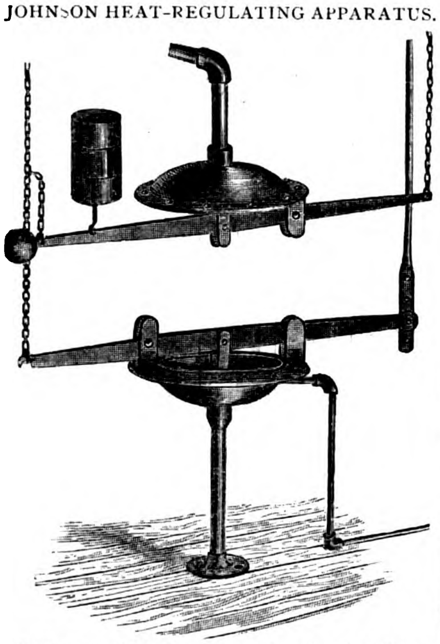
KELLY & JONES CO.,

75 JOHN STREET, NEW YORK.

National Electric Service Co.,

CONTROLLING

JOHNSON HEAT-REGULATING APPARATUS.



By the use of this invention the heating of building to an exact and uniform temperature is accomplished Rooms and Auditoriums may be kept at any temperature desired, thereby saving fuel, discomfort, ill health, the cracking of wood-work, furniture, pictures, etc.

This apparatus applies equally well to all forms of heating and ventilating devices, the thermometer in the room automatically governing the temperature. It is invaluable in Public Buildings. Private Residences, Churches, Hospitals, Schools, Conservatories, Factories, etc.

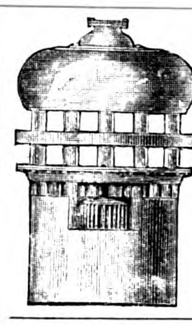
DENVER, April 19, 1886.

GENTLEMEN:—The Electric Valve Service in use in our office during the past winter, has proved very satisfactory. By its use we have had a uniform temperature of seventy degrees in all kinds of weather. We know it adds to every comfort; we believe it has a healthful effect.

Very truly yours,
S. M. WOOD.
Cashier First National Bank of Denver.

SEND FOR CATALOGUE "E."

NEW YORK: 686 BROADWAY.
CHICAGO: 195 WABASH AV.
BOSTON: 611 WASHINGTON ST.



STEAM-HEATING.

PAGE'S NEW *"All Right" Steam-Heater*

Is the cheapest and most economical boiler ever produced. Everything about it perfect.

Send for circular.

The Combination Co.,
Wm. H. Page, *Treas.*,
Norwich, Conn.

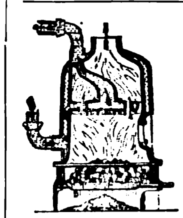
STEAM-HEATING PROBLEMS.—A selection from the pages of THE SANITARY ENGINEER, *of questions and answers, also comments on problems met with in designing and constructing steam-heating apparatus. Large 8vo., handsomely bound. Sent post-paid on receipt of* $3.00. *Address Book Department,* THE SANITARY ENGINEER, 140 *William Street New York. P. O. Box* 3037.

GREEN-HOUSE Heating & Ventilating

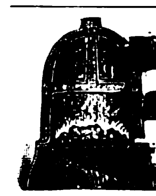
Boilers for Heating Water for Baths.

HITCHINGS & CO.,
233 MERCER STREET, NEW YORK.

Send 4 cents postage for Illustrated Catalogue



Hot-Water Boilers,
FOR
GREEN-HOUSES,
BATHS, ETC.
JNO. A. SCOLLAY,
74 and 76 Myrtle Ave., Brooklyn.
Catalogue sent on application

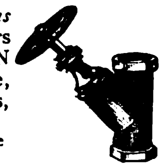


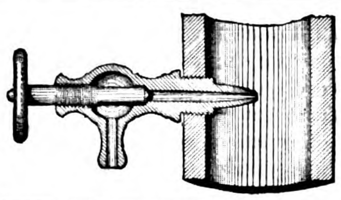
HOT-WATER BOILERS
FOR
HEATING DWELLINGS,
GREEN-HOUSES, ETC.
THOS. W. WEATHERED,
46-48 Marion St., N. Y.
Send for Illustrated Catalogue.

THE RUSSELL VALVE, After fourteen years' tests, is steadily growing in favor. It has a *Jenkins Composition Movable Disk* that will usually last two years and is readily replaced. Manufactured only by T. R. McMANN & BRO., Agents for The Davis Patent Automatic Air-Valve, and Manufacturers of and Dealers in Brass and Iron-Fittings, Valves, Cocks, etc., for Steam, Water, Gas, and Oil.

Send for Revised Price-List and Descriptive Catalogue

56, 58, and 60 Gold Street, N.Y.





PATTERSON'S

IMPROVED AIR-VALVE

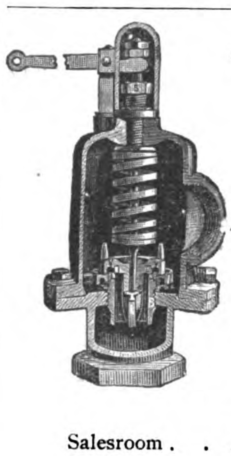
Pat. March 27, 1883.

MANUFACTURED BY

H. PATTERSON, ALBANY, N. Y.

For sale by first-class jobbers.

CHAS. A. MOORE, Pres. MARTIN LUSCOMB, Treas. GEO. W. RICHARDSON, Supt.



The Consolidated Safety Valve Company.

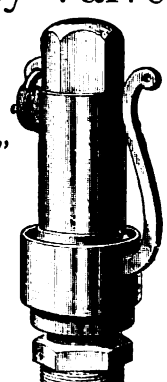
CAPITAL, - $100,000.

MANUFACTURERS OF

THE ONLY NICKEL-SEATED "POP" SAFETY-VALVE.

Approved by U. S. Board of Steamboat Inspectors. Adopted by U. S. Navy in all the Steel Cruisers.

It will always pay Dealers, Boiler-Makers, and Owners of boilers to address us for catalogue and prices before placing orders for "POP" Safety-Valves.

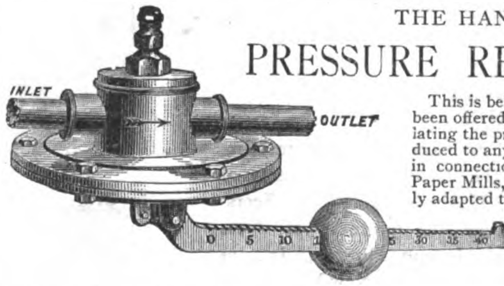


Salesroom . . . 111 LIBERTY STREET, NEW YORK.

NEW FACTORY, BRIDGEPORT, CONN.

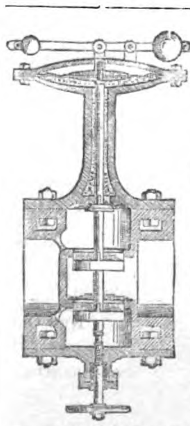
THE HANDREN & ROBINS

PRESSURE REGULATING VALVE.



This is believed to be the Simplest and Best Device that has been offered to the public, for the purpose of reducing and regulating the pressure of steam, so that high pressures can be reduced to any lower pressure that may be required. It is useful in connection with Steam-Heating Apparatus, Bleacheries, Paper Mills, Rubber Works, Sugar Refineries, etc. It is equally adapted to reducing pressure in Water-Pipes. Send for Circular and Price List.

WALWORTH MFG. CO.,
16 OLIVER STREET. BOSTON, MASS.



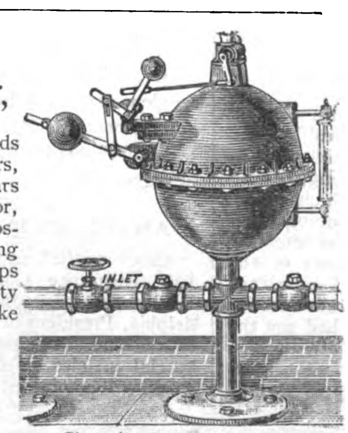
Eureka Pressure-Regulator

EUREKA

Pressure-Regulator,

For reducing the pressure on all kinds of Heating Apparatus, Drying Cylinders, Brewing Kettles, etc. Send for circulars of Regulator, Common-Sense Lubricator, Champion Return-Steam Trap, and Positive Acting Pump-Governor for returning condensation where Return-Steam Traps are not suitable. A responsible party wanted (in the trade) in every city to take the sole agency.

TIMOTHY KIELEY,
7, 9, and 11 West 13th Street, N. Y.
WRITE FOR TERMS.



Champion Return-Steam Trap.

PHILADELPHIA, PA.

ORLANDO KELSEY,
STEAM-HEATING,
510 ARCH STREET.

BARTLETT, HAYWARD & CO.

Manufacturers of HOT WATER (High and Low Temperature) STEAM (High and Low Pressure) HEATING APPARATUS. Furnish Plans, Specifications and Superintendence for the Heating and Ventilating of Public Buildings.

Water-Heating a Specialty.

Established 1816 BALTIMORE, MD

Steam-Heating.

GILLIS & GEOGHEGAN,
NO. 116 WOOSTER STREET,
Above Spring, 3 blocks west of Broadway.

BUFFALO FORGE CO.,
MANUFACTURERS OF THE
"BUFFALO"
Blowers, Exhausters, Steam-Fans,

Exhaust Ventilating-Wheels and Hot-Blast Apparatus. Special Attention given to Warming and Ventilating Buildings, and all purposes where BLOWERS and EXHAUSTERS are used.

J. C. HENDRY, Consulting Engineer. BUFFALO, N. Y

Jno. D. Ripley, *Sec'y & Treas.* A. W. Benedict, *Pres.* John B. Hughes, *Vice-Pres.*

St. Louis Steam-Heating AND *Ventilating Company,*

Contractors for Heating by most approved Methods Stores, Residences, Churches, and all Public Buildings. Plans, Specifications and Estimates furnished.

No. 901 N. Main Street, ST. LOUIS

Jarecki's Screw Plate and Pipe Cutter.

Write for Discount and Description.

Improved adjustable guides

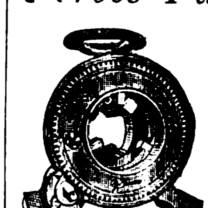
Improved cut-off knife.

No. 1 cuts off and threads ¼, ⅜, ½, ¾ $14
No. 2 cuts off and threads ½, ¾, 1, 1¼ $16
No. 3 cuts off and threads 1, 1¼, 1½, 2 ...... $20
No. 3½ cuts off and threads ½, ¾, 1, 1¼, 1½, 2 .$27.50
No. 4A cuts off and threads 1½, 2, 2½, 3 ....$35
No. 4B cuts off and threads 2½, 3, 3½, 4 ....$50
No. 5 cuts off and threads 4½, 5, 6 ....$75

JARECKI MFG. CO., ERIE, PA.,

Manufacturers of Malleable and Cast Iron Pipe Fittings, Brass and Iron Valves and Cocks for Steam, Gas, Water, and Oil; Pumps, Machinery, and Supplies for Artesian Wells. Illustrated catalogue on application.

FORBES & CURTIS,
MANUFACTURERS OF THE
Forbes Pat. Die-Stock,



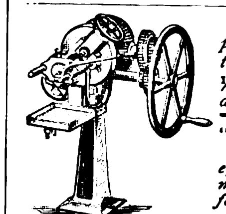
PIPE-CUTTING AND THREADING MACHINES For Hand or Power.

Cutting-Off Machines, Ratchet-Drills, Etc.

Send for Catalogue.

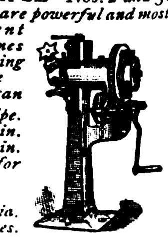
Mention this paper. BRIDGEPORT, CONN.

"Eclipse" Hand Pipe-Cutting Machines.



No. 1.—Powerful, inexpensive, simple in construction. Cuts and screws pipes ¼ to 2-inch. Easily carried about.

"ECLIPSE" Nos. 2 and 3. These are powerful and most efficient machines for cutting large PIPES, with which one man can easily cut off and thread 6-inch pipe. No. 2 Cuts and Screws 2½ to 4 in. No. 3 " " " 2½ to 6 in. It will pay you to write us for particulars.



PANCOAST & MAULE.
[*Mention this paper.*] *Philadelphia.*
We also build Power Machines.

LEBOSQUET BROS.

Send for Descriptive Pamphlet

STEAM-HEATING APPARATUS.

Combining the latest improvements.

Heating Residences a Specialty.

LEBOSQUET BROS., 75 Union St., Boston.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 2. PUBLISHED EVERY SATURDAY.

NEW YORK, DECEMBER 11, 1886.
LONDON, DECEMBER 25, 1886.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 140 William Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

RIVER POLLUTION.

THE steadily increasing importance of the subject of the pollution of fresh-water streams in this country by the discharge into them of sewage and waste products of various kinds is well known to engineers and sanitarians, and public opinion is being rapidly educated on the subject by reports of health boards and health officers, and through the agency of the daily press. Even yet, however, very few persons have any clear ideas as to the amount and variety of such pollution as is even now occurring, or of the number, the difficulty, and the importance of the problems which must be settled in regard to it by the manufacturers, chemists, engineers, legislators, and jurists of the not distant future.

To those who wish to obtain some definite information as to the number and variety of these problems we recommend a careful reading of the report of the sanitary survey of the Schuylkill River Valley made by Mr. D. C. Barber, under the direction of the Water Department of the city of Philadelphia, to determine the character and amount of the various sources of pollution of that stream. This report is made a part of the report of the Committee on Water-Supply, Drainage, etc., of which Mr. Rudolph Hering was chairman, which is printed in the first annual report of the State Board of Health of Pennsylvania, recently published, and which we shall notice hereafter.

Mr. Barber divides the valley into seven districts, each ending just above some important town, and generally at a pumping-station. The first division, for example, includes the whole valley above Reading, having a population of about 91,000, and an area of about 657 square miles. Within this region the streams are polluted by mine-water containing large amounts of sulphuric acid, by privies, sewers of Pottsville, and gas-works, brewery, tannery, glue-works, etc., wastes. In other sections there were found discharging into the stream the waste products from paper-mills, packing-houses, bleaching and print works, woolen-mills, chemical-works, oil-works, etc., etc., and the result is summed up in the statement that "the Schuylkill, above Fairmount Dam, is the natural sewer, first and last, for a population of about 350,000, largely engaged in manufacturing, and whatever may be the varying judgment of physicists as to the power of a running stream to purge itself of foreign contamination, it is very certain that the river itself has, from time to time, furnished the most convincing evidence of its inability to digest or dispose of the extraneous and injurious matters discharging into it."

Consider now these facts in connection with the charge of Judge Thayer in a test suit brought against the proprietors of one of the sources of pollution above indicated. The judge says: "It is a very old and well-settled law that to pollute a public stream is to maintain a common nuisance. It is not only a public injury, but it is a crime—a crime for which those who perpetrate it are answerable in a court of criminal jurisdiction. * * * It is no defence to say that the premises are in the same condition and the drainage conducted in the same manner as when they obtained possession. * * * No length of time can justify a public nuisance, although it may furnish an answer to an action for private injury. Public rights are not destroyed by private encroachments, no matter how long they have been endured.' Nor is it any defence that the river is also polluted from other sources. * * * Nor ought your verdict to be affected in the slightest degree by the suggestion that, if these pollutions of the river are stopped by indictments and convictions, the effect may be injurious to large business interests. * * * The law is above every personal and private interest. All persons engaged in business are bound to conduct that business in subordination to the law, and in such manner as not to injure the public."

Evidently there is trouble ahead for some people and communities in the Schuylkill Valley, and the same is true for many other valleys in this country.

CHICAGO'S URGENT NEED.

THE thorough examinations in progress in Chicago, with the object of discovering the most feasible method of keeping the water-supply pure and of disposing of the polluted liquid waste of the great city, have reached a point where it is necessary for the City Council to act promptly in determining whether the work already done is to be carried to completion and the conclusions of the commission formulated, or whether the surveys and researches are to be left incomplete and practically useless.

The appropriation of $30,000, made on June 27, 1886, for the expenses of the investigation, is almost exhausted, the balance in hand being only sufficient to defray the expenses up to December 14. The commission ask for an additional appropriation of $20,000 to enable the requirements of the resolution under which they are acting to be fulfilled and a thorough report made.

It is not improbable that in defining the duties of the commission the City Council were not fully aware of the magnitude of the work they were imposing on it. It is not unlikely, too, that the commission itself did not realize the immense scope of the investigations needed to determine the problems of water-supply and sewage disposal for the most rapidly growing city in the world in a manner that will not appear absurdly inadequate ten years hence.

Mr. Hering has wisely undertaken a thorough investigation, which involves a large amount of topographical and hydrographic work and the reduction and compilation of the notes of the surveys and the study of the problems presented by them. In such work it is inevitable that new and unexpected facts are presented to the investigators and lines of research suggested which must be followed for a certain distance before it can be determined whether they are worth tracing to the end. This takes time and money, and in the hands of inexperienced observers foolish waste of both is likely to occur, but there is no danger of this being the case in the Chicago investigations.

It is clearly the duty of the City Council to make the appropriations needed, and, judging from the summary given by the engineer of the work in progress, it would seem as if the amount asked for was less than the service is worth. The report of the commission will be worth far more than $50,000 to the city, and would be cheap at double that sum. It is to be hoped that the commission will not be hampered and delayed by any false ideas of economy on the part of the authorities who supply the funds.

WE notice in our Philadelphia exchanges that the Sanitary Committee of the Philadelphia Health Board recommend that the sewage-polluted water of the Delaware be not delivered directly to the citizens of Kensington, but that the Chief Engineer of the Water Department be requested to *store the water in the reservoir* before it is distributed through the supply-pipes. This is rather a remarkable recommendation from any supposed sanitary authority. We understand that the Kensington water is taken from the Delaware River near the outfall of several sewers—a very objectionable intake, as has frequently been pointed out—yet it would seem that the Philadelphia Board of Health expect that this sewage-polluted water will be *improved* by storage. A turbid water, doubtless, may be clarified by sedimentation, but sewage-polluted water if taken from a running stream and kept comparatively stagnant in a reservoir will become worse. Whatever advantages may be gained by aeration as a result of a flowing stream are certainly lost when this same water is impounded, and the advice of the Philadelphia Board is therefore to be regretted.

WE elsewhere print a report to the American Institute of Architects, read at its last convention by one of its members, Mr. Glenn Brown, of Washington, which is a valuable contribution. Such disinterested work as is here reported is very creditable. Moreover, it is of value, since the investigations were evidently conducted to get at the real facts, no unusual conditions were arranged, and no misleading conclusions are drawn. As was to have been expected, the results secured by Messrs. Philbrick and Bowditch in their investigations for the National Board of Health have been again reached. Mr. Brown, like Messrs. Philbrick and Bowditch, had no commercial interest to serve by securing special results, consequently his experiments were fairly and intelligently conducted, and his conclusions are entitled to consideration. The facilities of the Museum of Hygiene are well availed of in investigations of this character.

OUR BRITISH CORRESPONDENCE.

False Report of the Death of Mr. George Godwin—Cost of Electric Lighting—Railway Viaduct between England and France—Petroleum Reservoir in Amsterdam Harbor.

LONDON, November 24, 1886.

IT is of interest to architects to state that the appreciative obituary notice of Mr. George Godwin, F. R. S., F. S. A., and late editor of the London *Builder*, which appeared in the *American Architect* of 30th ult., is premature. • Mr. George Godwin is alive and well. The error has risen in connection with the decease of a Mr. E. W. Godwin.*

The city of London authorities, when they tried the electric-light for street-lighting some three years since, found that it was attended by an expense in working and maintenance in excess of that of gas—in fact, in some cases, it was three times as much. I see that a portion of Liskeard is now being lit with the electric-light, the experiment being carried out with eight arc-lamps of 1,200 candle-power each. It remains to be seen what the experience as to reduction of cost will be.

An emulator of the courage of M. Lesseps has just propounded a scheme for connecting England and France by a viaduct railway, which places the latest project of the veteran engineer altogether in the shade. It is stated that a Mr. Hersète has laid his project before the Bordeaux Chamber of Commerce, who warmly approve of it. The estimate for this undertaking is, for masonry and foundations, 352,000,000 francs; iron-work, 525,000,000 francs; approaches on the French side, 22,000,0000 francs; on the English, 13,000,000 francs; sundry, 8,000,000 francs; total, 920,000,000 francs, or $176,640,000. To this would, of course, have to be added the interest on the money during construction, say another 92,000,000 francs, in ten years.

In anticipation of the future that is predicted for petroleum as a fuel, a large reservoir, to store 1,740,000 gallons, is being erected in the outer harbor of Amsterdam.

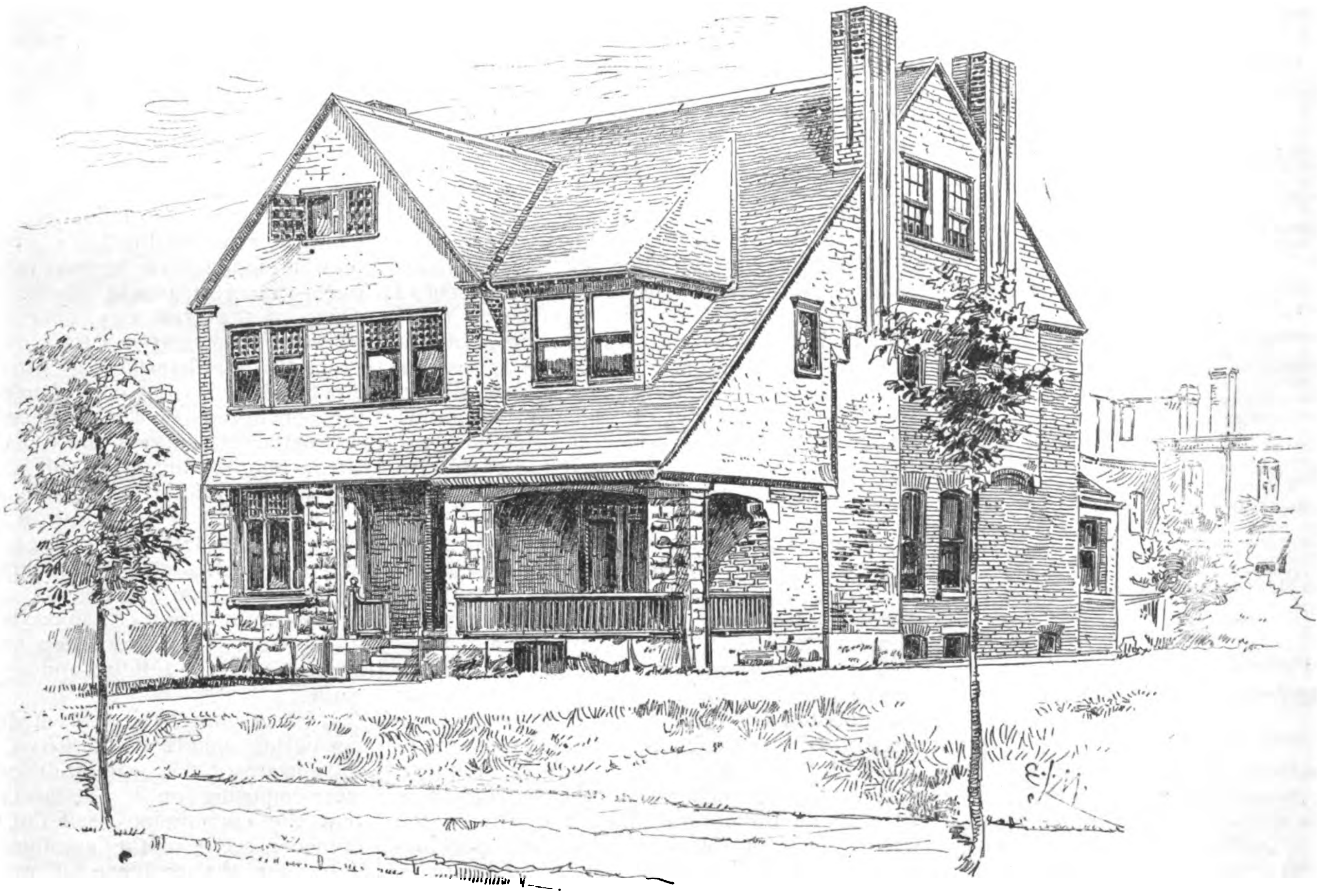
SAFETY-VALVE.

* We were ourselves misled by the cablegram, and noticed the death of Mr. Godwin in our issue of November 6. The things said of him are as true now that he is living as they were when he was "dead," and his friends have the satisfaction of knowing that Mr. Godwin is alive to hear them for himself.

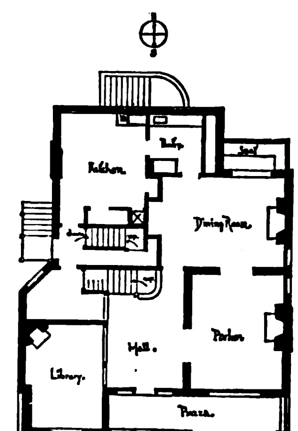
HEALTH OF THE U. S. ARMY.

THE annual report of the Surgeon-General for 1885 shows that our soldiers, like the greater part of the rest of the world, were unusually healthy during that period.

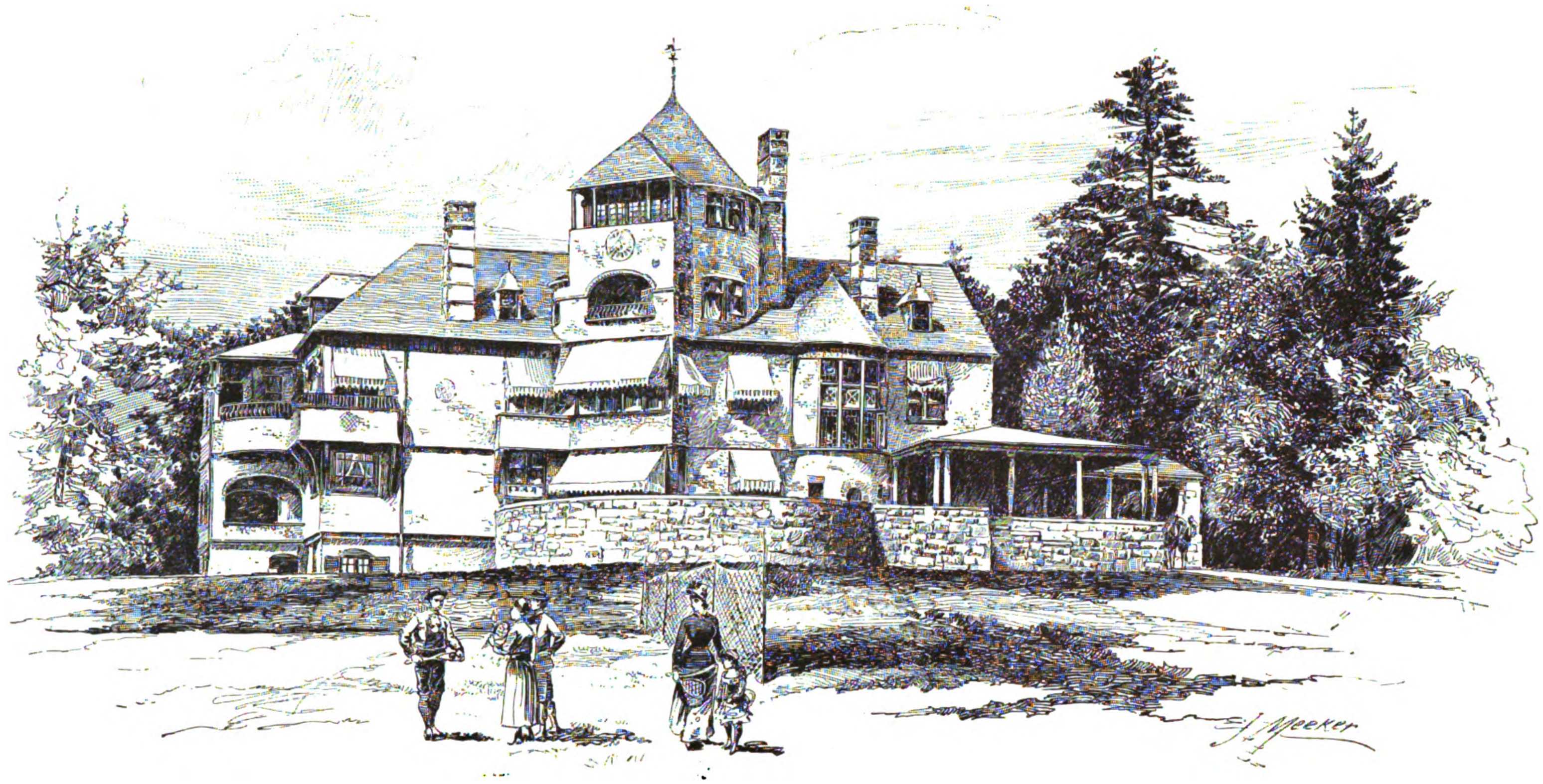
The actual number of admissions to sick report was 32,990, or 3,839 less than for the preceding year. Compared with the average rate for ten years preceding the admissions were about one-fifth less. It is shown that a greater proportion of invalids was furnished by troops under thirty-one years of age, while up to the age of twenty-five the rate proved so much above the mean for the whole army that the Surgeon-General says it may be fairly questioned whether the services rendered by these young men are equal to the cost of their maintenance. Men of Irish birth furnished the highest mortality rate, or 7.9 per thousand, the English stood next, and the Germans third. Attention is called to the number of medical officers permanently disabled, to the serious embarrassment of the department, and legislation is urged to afford relief by the addition to the force of young and active men. It is also strongly recommended that a board be detailed to prepare a plan of organization for a hospital corps suited to the conditions of the Army, with a view to Congressional action.



A ST. LOUIS RESIDENCE.—WILLIAM S. EAMES AND THOMAS C. YOUNG, ARCHITECTS.



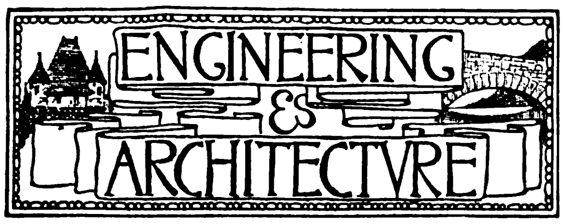
FLOOR PLAN OF ST. LOUIS RESIDENCE.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCE OF SPENCER TRASK, SARATOGA SPRINGS, N. Y.

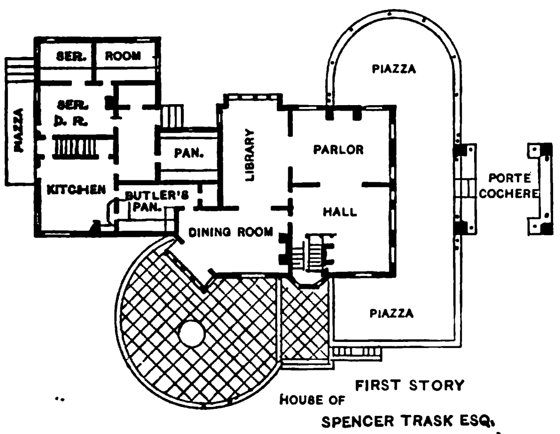
A. PAGE BROWN, ARCHITECT.



OUR SPECIAL ILLUSTRATION.

A RESIDENCE AT SARATOGA SPRINGS, N. Y.—A. PAGE BROWN, ARCHITECT.

OUR special illustration this week shows the residence of Mr. Spencer Trask, at Saratoga Springs, N. Y. The first story is constructed of Perth Amboy brick, 12 inches long and 1½ thick, of gray buff color. The terrace walls are of rock-face limestone. The walls of the house above the first story are shingled, not painted, but allowed to stain with the weather. The parlor is white and gold, high wainscot, and large mantel, with onyx columns—all



n colonial style. The dining-room is finished in cherry, the library in stained oak, and the hall has a ceiling divided in large panels by oak braces; panels colored dark brown, and fitted with gilt and arabesque stencil-work. The terrace is paved with red tiles, 12 inches square, and a fountain is built into the outside wall of staircase bay. The fountain is of modeled terra-cotta, shell top and basin, with dolphin spout. The architect is Mr. A. Page Brown, of New York.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A ST. LOUIS RESIDENCE.—WILLIAM S. EAMES AND THOMAS C. YOUNG, ARCHITECTS.

THE subject of our vignette illustration this week is the residence of Mr. George H. Holland at St. Louis, Mo. The material used was Lake Superior red sandstone (split face), red brick gables, and roofs of red slate. The hall and library are finished in quartered oak, paneled to height of doors, and beam ceiling and panels. The parlor and dining-room are of stained yellow poplar.

The architects were William S. Eames and Thomas C. Young, of St. Louis.

AMERICAN INSTITUTE OF ARCHITECTS.

THE twentieth annual convention of the American Institute of Architects met December 1, by the courtesy of the New York Mutual Life Insurance Company, in the Directors' Room of that building.

President Thomas U. Walter, LL.D., of Philadelphia, in the chair. A large membership was present, consisting of delegations from the different chapters, and individual members from North, South, East, and West.

The Western Association of Architects were represented by Mr. Root, of Chicago, and Mr. Smith, of Omaha.

Mr. Mason, Secretary, A. I. A., having been called suddenly home, Mr. A. J. Bloor was appointed Secretary *pro tem*.

The President then read his annual address. He referred to the progress of art during the past year, called attention to the necessity of keeping up fraternal and social relations, deprecated professional animosities, and noted some of the evidences of progress in buildings, calling attention to the growing tendency of the beautiful in art, especially as illustrated in terra-cotta and brick work.

The tendency of architects to do their own thinking, he claimed, is everywhere apparent, and to be commended as long as it does not degenerate into license; thus an American development of architecture is slowly taking place. Attention was called to the spread of architectural associations, which are now many, and all the principal centres of the East and West are now represented. The result is apparent in the promotion of artistic merit and intelligent knowledge of practical matters.

Mr. A. J. Bloor, Secretary *pro tem*, then read the report of the Board of Trustees, giving an account of meetings for business during the past year. It referred to the report made by the delegate chosen to represent the A. I. A. at the first convention of the Western Association of Architects. The names of honorary and active members deceased during the year were read. Attention was called to the committee formed for urging the passage of a federal act for the promotion of architectural competition, with special reference to public buildings, and its action in joint committee with the Western Association of Architects.

The report also called attention to the action of the Boston Chapter in a circular letter addressed to other chapters to further the erection of some enduring monument to the memory of H. H. Richardson, late Fellow A. I. A. The institute was reported to be steadily growing in membership and influence. Seven new fellows and six new associates were elected during the year—one associate was promoted to fellow, two associates have resigned. There are now 192 professional members.

A movement is on foot for the establishment of new chapters in Indianapolis, Ind., and Pittsburg, Pa.

The report was referred to a special committee, to be named by the chair, to report later to the convention.

The special committee upon the various reports reported that the Committee on Federal Architecture be continued on the part of the institute in conjunction with that appointed by the Western Association, with power to act.

The special committee reported favorably, and generally endorsed the recommendations of the various chapters, but were unfavorable to suggestions in the latter part of the Treasurer's report. The Auditing Committee reported the Treasurer's report and vouchers to be correct. Reports of committee were adopted. The Nominating Committee reported its choice of officers and committees for the ensuing year as follows:

Thomas U. Walter, LL.D., of Philadelphia, President; A. J. Bloor, of New York, Secretary; O. P. Hatfield, of New York, Treasurer; Trustees, H. M. Congdon, of New York; N. Le Brun, of New York; E. T. Littell, of New York; R. M. Upjohn, of New York; Committee on Publications, H. H. Holly, New York; T. M. Clark, Boston; Charles Crapsey, Cincinnati; J. McArthur, Philadelphia.

Mr. O. P. Hatfield, Treasurer, then read the Treasurer's report: Received from fees, etc., \$1,389.50; balance from last year, \$263.64; total, \$1,653.14; disbursements, \$1,512.10; balance on hand, \$141.04.

There was reported a nucleus of a fund for a building for the purposes of the institute, which was greatly needed.

All matters in this report not relating to finance was referred to the special committee for report to the convention.

The Auditing Committee on Treasurer's report was appointed by the chair—viz., Messrs. Stone, Holly, and Hunt.

At this point of the proceedings the delegation from the Western Association of Architects, Messrs. Root and Smith, was announced and invited by vote of the convention to take part in its deliberations. Mr. Root replied in behalf of his association in a few fitting and graceful words of appreciation; stating that the Western Association was in no sense a rival, but that they were fellow-workers in the same cause, so happily upheld by the American Institute of Architects.

Reports from the chapters were then read:

New York Chapter showed that its membership had increased, that its examining committee had been often called upon to exercise its functions with reference to the New York Building Law.

The Willard Commission were reported as considering the important question what to choose from the selection of casts, etc., gathered by Mr. P. Le Brun; they also reported that the corner-stone of the building to contain them had now been laid. Report was referred to special committee.

Philadelphia Chapter reported that the contemplated meeting of the society at members' homes had been very successful; they referred to the municipal bay-window order which had been repealed by vote of the Common Council, through the architects' efforts, but was vetoed by the Mayor, with no action upon thereto.

The ordinance now existing compelling proper plumbing practice, and the enforcement of sanitary laws, had been effected by the efforts of the chapter.

Report was referred to special committee.

Rhode Island Chapter reported that its monthly meetings had continued. The committee on entertainments had successfully carried out their duties. A list of subjects was prepared for discussion at the monthly dinners; also problems for working out.

Referred to special committee.

Baltimore Chapter reported the usual meetings; a good library, but the attendance was not as large as it should be.

Referred to special committee.

Chicago Chapter reported increased membership and interest. Its President, Mr. Jenney, who is also the Secretary for Foreign Correspondence, not being present, wrote that he had attended to his duties in sending notices of condolence to families of honorary members deceased abroad, and had received replies.

Referred to special committee.

The chair appointed as special committee for considering foregoing reports, Messrs. Renwick, Cutler, and Frederick.

The committee on nomination of officers for ensuing year was then appointed by the chair—viz., Messrs. Hunt, Nickerson, and Wallingford.

Next in order on the programme was the subject of an Architect's Protective Association, introduced at the last convention in a paper by T. M. Clark, of Boston, describing such an association among French architects, with a view to considering its possibility here. Mr. Clark's paper was read (see proceedings of last convention), the idea being the establishment of a fund for defence in lawsuits between architect and client. This was discussed informally and referred to a special committee of one, appointed by the chair with instructions to report as soon as possible to this convention. Mr. Frederick, of Baltimore, was so appointed to present some ideas on the subject for discussion.

Mr. Glenn Brown, of Washington, D. C., read a paper on trap-ventilation, and described apparatus and experiments testing its efficiency.

The paper was referred to publication committee for printing, and appears in this journal.

Mr. Frederick read a paper upon "Professional Ethics in Architectural Practice," giving as its definition "the courtesy that is owing one to another in the profession," and stating that this code is especially requisite in the arts.

The question was asked, What constitutes the professional code, who is the arbiter, and what are its recognized usages? The speaker claimed that the constitution of by-laws of the American Institute of Architects, and of kindred societies from the constituted authority, and their officers should decide disputed questions. The speaker stated that the fraternal feeling does not exist as it should, and aroused much sympathetic interest by giving examples of unfair dealing in the case of brother architects, with statements of grievances which were mentioned upon personal authority, and were in great measure of personal experience. He called for the support of the Board of Trustees and this convention.

The paper caused some excitement, and it was felt that the speaker served as a mouth-piece for many who kept silence. He promised to substantiate all he said.

The paper was referred to a special committee to investigate the charges and to report upon individual cases which may have caused the severe remarks in the paper just read. Messrs. Wallingford, Cutler, and Moser were so appointed by the chair.

The meeting adjourned at 2 P. M., to give opportunity for visiting architects to examine any special buildings or works of art that might interest them, under the guidance of members of the New York Chapter.

In the evening an informal meeting was held at the rooms of the Architectural Department of the School of Mines, Columbia College, Prof. William R. Ware being in attendance to explain the working of his department.

Many were present, various designs and models were exhibited, as well as the well equipped library of books and photographs. Mr. Bell, the Supervising Architect of the Treasury, U. S. A., was present (as also at the morning session), and exhibited a series of photographs of the Government work done under him, and Mr. Bloor showed photographs of buildings and views in Bermuda, from which place he had recently returned. Mr. Moser also showed original drawings, and gave his ideas upon originality and symbolism in art, with special relation to architecture.

SECOND DAY.

December 2, the convention was called to order by President Walter.

Mr. Bloor read a paper, being an account of his visit to St. Louis as a delegate from the A. I. A. to the convention of the Western Association of Architects, this paper forming his report to the Board of Trustees. He told of the joint operation of the two associations with special reference to their action on the bill drawn up by the institute for the improvement of the architectural status in the case of Government buildings, and the establishment of a properly guarded competition, being an improvement upon the Stockslager bill. Mr. Bloor spoke of his cordial reception, and the visit to Washington of the joint committee. Referred to special committee already appointed.

Mr. Bell, Supervising Architect of the Treasury Department, spoke of a pamphlet which he had sent to Prof. Ware for the use of the convention, which stated the present status of the bill referred to above, and the action thereon. He was desirous of knowing what the committee had done and how he could render assistance. He felt that there were faults in the bill which were fatal, and that another should be formulated that would have some chance of passing.

Mr. Bloor stated the position of the bill, and Mr. Kendall moved that this convention appoint, together with the Western Association, a committee to confer with Mr. Bell in the formulating of a new bill that would be generally acceptable. The motion was carried by unanimous vote, Mr. Root promising prompt action on the part of his association.

Mr. Moser read a paper upon architectural design, which was forcible and humorous, pleading strongly for originality, hoping for the time when foreigners would copy us as eagerly as we now do them.

Mr. Charles F. Wingate was introduced and made a brief address which was attentively listened to. He took the ground that architects did not give sufficient attention to the sanitary conditions in planning houses, and cited instances of well-known buildings in which he stated defects existed requiring the services of a sanitary expert.

He dwelt particularly on the importance of making houses damp-proof and water-proof, citing numerous diseases as resulting from soil moisture. He alluded to the typhoid fever outbreak in a section of Brooklyn last year, and stated that in the particular district affected none of the houses had traps on the main drain, the absence of which traps he considered as offering facilities for the spread of this disease. He stated that most skylights now put in buildings did not act as ventilators, but were made tight. He thought the tendency for decoration and fitting up the interiors had the result of excluding light. He indorsed the requirements of the Board of Health of this city in requiring cast-iron pipe in the houses, and stated that in his experience he had never seen but one earthen pipe house-drain laid in which the joints were tight. He concluded by urging that the sanitary question should be taken up vigorously, and especially by architects.

The following committees were now appointed:

Committee on Education, Alfred Stone, Providence; H. Van Brunt, Boston; Professor N. Clifford Ricker, Champaign, Ill.; T. M. Clark, Boston; Professor W. R. Ware, New York.

Secretary for Foreign Correspondence, W. L. B. Jenney, Chicago, Ill.

Mr. Frederick reported on the subject of the Architects' Protective Association, and stated in detail how it could be made applicable to the profession in the United States, but wished the subject to be considered as open to free discussion upon any recommendations of his own. He would support a joint committee with the Western Association to carry out the purpose of establishing such a society here to report to the next convention, or to a committee of conference.

It was moved that the subject be discussed. Mr. Root promised to appoint a committee on the part of the Western Association.

After various members had expressed themselves, the chair appointed on the part of the institute Messrs. T. M. Clark, of Boston, and Mr. Frederick, of Baltimore, and on the part of the Western Association Mr. Root, of Chicago, and Mr. Smith, of Omaha, a joint committee, to have power to appoint a fifth member.

The committee appointed to consider charges relating to unprofessional conduct reported that documentary evidence laid before them seemed complete and conclusive. A member of the institute did (as stated) frequently offer his services for less than the regular rates, and did testify in court against the charges in the schedule of the institute, which are endorsed by it as usual and proper. The mild censure in the report of the Board of Trustees seemed not to meet the case, and the committee recommended that the Board of Trustees ask for the resignation of the offending member; and also they recommend that in any such future case the offending member be expelled. They also recommend the appointment by the board of a standing committee to consider all such cases.

Upon motion, the report and recommendations were adopted by vote of the convention.

Tellers were then appointed by the chair to receive ballots for election of officers and trustees. The ticket as named by the Nominating Committee having the majority of votes was declared elected. Mr. Kendall moved that the election of President Walter be made unanimous, which was done by vote of the convention. The President replied in a few words of much feeling.

Mr. Bell made a motion that a committee of five be appointed by the chair to provide a permanent home for the institute, and made a few remarks as to its expediency and necessity.

Mr. Littell urged the importance of the same question, and advocated the formation of a stock company for this purpose.

Mr. Hunt opposed the idea, and stated that the A. I. A. was national, and not local, but that the New York Chapter should have such a building, which was not necessary for the institute.

Mr. Upjohn followed in favor of the motion. After some discussion, Mr. Hatfield moved as an amendment the appointment of a committee of two, and named Mr. Bell and Mr. Littell. The motion was put and carried, and the committee instructed to report the result of their deliberations to next convention.

Mr. Hunt extended to the visiting architects the invitation of Mr. H. G. Marquand to visit and examine his house on Madison Avenue, together with his collection of works of art.

Mr Kendall moved the thanks of the architects for the use of the Directors' Room, kindly furnished by the New York Mutual Life Insurance Company. Motion passed unanimously.

Mr. Wallingford, of Minneapolis, moved the thanks of the visiting architects for courtesies extended by the New York Chapter. Passed.

Upon motion the convention then adjourned to meet at the call of the Board of Trustees.

In the evening the architects enjoyed the annual dinner at Pinard's, which was tendered by the New York Chapter of the American Institute of Architects.

Thursday afternoon a real treat was enjoyed by those architects fortunate enough to be present. Through the courtesy of Mr. Henry G. Marquand an inspection of his wonderful house was permitted. The interest of the occasion was much enhanced by the presence of Mr. Richard M. Hunt, the architect of the building, who, as no one else could, conducted the visitors from one room of interest to another, and, when the wonder of the famous Japanese room excited exclamations of delight, Mr. Hunt took particular pains to have it understood that the designs for this room were the special work of Mr. Manley Cutler, of this city.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE seventh annual meeting of the American Society of Mechanical Engineers convened November 29, at the hall of New York Academy of Medicine, Vice-President H. R. Towne in the chair, President Coleman Sellers being unavoidably absent in England on account of ill health.

The session was well attended throughout, often as many as two hundred members and guests being present out of more than three hundred who had registered.

The following members were present:

Horatio Allen, South Orange, N. J., George I. Alden, Worcester, Mass.; Francis B. Allen, Hartford, Conn.; John F. Allen, New York City; Thomas R. Almond, Brooklyn, N. Y.; Gardner C. Anthony, Providence, R. I.; Daniel Ashworth, Pittsburg, Pa.; George H. Babcock, New York City; W. S. G. Baker, Baltimore, Md.; Stephen W. Baldwin, New York; George A. Barnard, New York; James C. Bayles, New York; Arthur Beardsley, Swarthmore, Pa.; William Betts, Wilmington, Del.; Hugo Bilgram, Philadelphia, Pa.; Wyngood Bellhouse, Syracuse, N. Y.; James Butterworth, Philadelphia, Pa.; George M. Bond, Hartford, Conn.; J. V. V. Booraem, Brooklyn, N.Y.; James Brady, East Boston, Mass.; Morgan Brooks, Boston, Mass.; Henry W. Bulkley, New York City; Thomas S. Crane, Newark, N. J.; George W. Campbell, New York City; Thomas Wells Capen, Stamford, Conn.; R. C. Carpenter, Lansing, Mich.; William Lee Church, New York City; T. O. Borden, Portland, Conn.; A. C. Campbell, Bridgeport, Conn.; Charles L. Clark, New York; J. Wendell Cole, Columbus, O.; Alfred Colin, New York; C. C. Collins, Newark, N. J.; Charles H. Corbett, Brooklyn, N. Y.; Alfred B. Couch, Philadelphia, Pa.; David P. Davis, New York; Isaac H. Davis, Dorchester, Mass.; C. D. Cottrell, ———; James E. Denton, Hoboken, N. J.; William H. Doane, Cincinnati, O.; James M. Dodge, Philadelphia, Pa.; Faber A. Du Faur, New York City; W. F. Durfee, Bridgeport, Conn.; Jarvis B. Edson, Brooklyn, N. Y.; Albert H. Emery, Stamford, Conn.; Charles E. Emery, New York; William D. Ewart, Chicago, Ill.; Roland G. Ewer, Brooklyn, N. Y., Arthur Falkenau, Scranton, Pa.; George L. Fowler, New York; James J. Ewart, E. A. Douglas, Philadephia, Pa., George L. Fowler, Brooklyn, N. Y.; C. H. Foster, Brooklyn, N. Y.; William Gibson, Jr., Brooklyn, N. Y.; Matthias N. Forney, New York; John Fritz, Bethlehem, Pa.; C. M. Giddings, Massillon, O.; John J. Grant, Fitchburg, Mass.; Joseph Leon Gobeille, Cleveland, O.; John H. Hall, ———; Garner C. Hawkins, Boston; O. S. Harmon, Jersey City, N. J.; William D. Hartshorne, Lawrence, Mass.; John T. Hawkins, Taunton, Mass.; F. F. Hemenway, New York City; John Henney, Jr., Hew Haven, Conn.; Gustavus C. Henning, New York City; Ludwig Herman, Cleveland, O.; J. A. Herrick, New York City; William Hewitt, Trenton, N. J.; Milton P. Higgins, Worcester, Mass.; William Hill, Collinsville, Conn.; C. C. Hill, Chicago, Ill.; H. A. Hill, Boston, Mass.; Gustav Hillmann, Westchester County, N. Y.; A. C. Hobbs, Bridgeport, Conn.; Herman Hollerith, Washington, D. C.; Sumner Hollingsworth, Boston, Mass.; Julius L. Hornig, Jersey City, N. J.; George F. Higgins, Manchester, N. H.; F. A. Hetherington, N. Y.; Charles W. Hunt, New York City; Frederic R. Hutton, New York City; Charles E. Hyde, Bath, Me.; Joseph J. Illingworth, Utica, N. Y.; Walter C. Kerr, New York City; William Kent, Jersey City, N. J.; Charles I. King, Madison, Wis.; Charles Kirchhoff, Brooklyn, N. Y.; Gaetano Lanza, Boston, Mass.; Walter C. Kerr, New York City; J. McBridge, Lawrence, Mass.; F. R. Low, Boston, Mass.; W. Barnet Le Van, Philadelphia, Pa.; Wilfred Lewis, Philadelphia, Pa.; Charles W. Livermore, Boston, Mass.; W. C. Mackinney, Philadelphia, Pa.; Charles H. Manning, P. A. Eng. U. S. N., Manchester, N. H.; Ferdinand Martens, College Point, L. I.; Alexander Miller, New York City; John W. Moore, New York City; Joseph Morgan, Jr., Johnstown, Pa.; Thomas R. Morgan, Sr., Alliance, O.; William F. Monaghan, New York; Daniel E. Moran, New York; H. P. Mind, Columbus, O.; Henry Morton, Ph. D., Hoboken, N. J.; Maurice A. Muller, Newark, N. J.; Edward J. Murphy, Hartford, Conn.; S. W. Murray, Milton, Northumberland Co., Pa.; Carleton W. Nason, New York City; William H. Odell, Yonkers, N. Y.; Charles H. Parker, Cambridgeport, Mass.; Edward H. Parks, Providence, R. I.; Henry Parsons, Newark, N. J.; William E. Partridge, New York City; Charles D. Parker, ———; Ferdinand Phillips, Philadelphia, Pa.; Franklin Phillips, Newark, N. J.; George H. Phillips, Newark, N. J.; Charles T. Porter, New York City; Holbrook F. J. Porter, New York City; Charles Potter, Jr., Plainfield, N. J.; Thomas F. Rowland, Greenpoint, N. Y.; A. H. Raynal, Hoboken, N. J.; A. Wells Robinson, Montreal, Can.; J. M. Robinson, New York City; Thomas F. Rowland, Brooklyn, N. Y.; J. A. Roch, Chicago, Ill.; Charles B. Rowland, Brooklyn, N. Y.; P. A. Sanguinette, Philadelphia, Pa.; William L. Sanders, New York; Adolph W. Schleicher, Philadelphia, Pa.; George Schuhmann, Reading, Pa.; Horace See, Philadelphia, Pa.; C. A. Smith, Pawtucket, R. I.; Oberlin Smith, Bridgeton, N. J.; Henry I. Snell, Philadelphia, Pa.; Albert Spies, New York City; William W. Sprague, Town of Lake, Ill.; Albert Stearns, Brooklyn, N. Y.; W. N. Stevens, Brooklyn, N. Y.; Norman C. Stiles, Middletown, Conn.; Allan Stirling, New York City; Karl J. Sunstrom, Worcester, Mass.; Ambrose Swasey, Cleveland, O.; John E. Sweet, Syracuse, N. Y.; Stevenson Taylor, New York City; Harris Tabor, New York City; Robert H. Thurston, Ithaca, N. Y.; Henry R. Towne, Stamford, Conn.; Alfred P. Trautwein, Brooklyn, N. Y.; William P. Trowbridge, New York City; F. H. Underwood, Tolland, Conn.; Lyman A. Upson, Thompsonville, Conn.; Aaron Vanderbilt, New York City; Charles N. Trump, Wilmington, Del.; Ferdinand W. Taylor, Germantown, Pa.; Frederick W. Taylor, Philadelphia, Pa.; William Watson, Boston, Mass.; Franklin Van Winkle, New York; B. H. Warren, Boston, Mass.; John Burkitt Webb, Hoboken, N. J.; Samuel S. Webber, New York; William Oliver Webber, Lawrence, Mass.; John H. Webster, Boston, Mass.; George W. Weeks, Clinton, Mass.; William H. Weightmann, New York; J. Leland Wells, New York; Thomas D. West, Cleveland, O.; Edward Weston, Newark, N. J.; Frederic M. Wheeler, New York; H. C. White, New York; Joseph J. White, Philadelphia, Pa.; Maunsel White, Bethlehem, Pa.; Moses G. Wilder, Philadelphia, Pa.; B. D. Whitney and William M. Whitney Winchendon, Mass.; J. H. Webster, Boston, Mass.; William Winter, Brooklyn; H. W. Wyman, New York; H. D. Williams, New York; Alexander K. Winter, Brooklyn; William H. Wiley, New York; Samuel T. Williams, Tacony, Philadelphia, Pa.; Alfred R. Wolff, New York; John Q. Wright, Fitchburg, Mass.; Robert R. Zell, New York.

In place of the presidential address, which was necessarily omitted, Mr. Horatio Allen, an honorary member and probably the oldest engineer in the country, delivered an *extempore* address, recounting some of his experience at the time of the inauguration of ocean steam navigation, which was full of interesting anecdote and useful instruction to mechanical engineers. After expressing sincere thanks to the venerable and esteemed honorary member, the society proceeded to the dining-room, where a sumptuous lunch was spread which added to the feast of reason the necessary flow of soul and spirits.

On Tuesday morning, November 30, the tellers reported the result of election of officers for the ensuing years as follows:

President (serves one year), George H. Babcock, of New York City.

Vice-Presidents (serve two years), Joseph Morgan, Jr., of Johnstown, Pa.; Charles T. Porter, of New York City; Horace S. Smith, of Joilet, Ill.

Managers (serve three years), Frederick G. Coggin, of Lake Linden, Mich.; John T. Hawkins, of Taunton, Mass.; Thomas R. Morgan, Sr., of Alliance, O.

Treasurer (serves one year), William H. Wiley, of New York City.

Next in order, the Committee on Finance reported increased prosperity of the society with unusually rapid increase in membership. After this the Committee on Standards for Pipe and Pipe-Threads, consisting of Messrs. F. Grinnell, George M. Bond, W. J. Baldwin, and George Schuhmann, reported that through their work in connection with the convention of pipe manufacturers, the latter have unanimously adopted the Briggs standard of pipes and pipe-threads. The Committee on Uniform Standards in Test Specimens and Methods of Test, consisting of Messrs. H. R. Towne, Thomas Egleston, R. H. Thurston, Charles H. Morgan, and G. C. Henning, reported considerable work done and progress made. After the routine work had been concluded, the presentation and discussion of papers was taken up. Heretofore it had been found that almost the entire time of the meeting was consumed by reading lengthy papers, and there was no opportunity for discussion, which is one of the essential objects of every convention. A new plan has therefore been adopted which gives almost the entire time for discussion, according to the arrangement as follows:

I. All papers to claim presentation at any convention must be in type three weeks in advance of the meeting.

II. When the secretary sends notice of the meeting he shall also send a blank by which the members may notify him of their intention to be present at it.

III. Copies of all the papers to be read shall be sent to every member *so signifying his intention to attend*. A blank shall accompany this packet of papers, by which the members may signify their intention to discuss any of the papers, and priority in debate shall be given in the order of such notification.

IV. At the convention papers shall be read by abstract only, not more than *five* minutes being allotted to the presentation. It is assumed that every one has made himself familiar with the papers beforehand.

V. Members who having given notice of their intention to discuss any papers shall have reduced their remarks to writing shall be entitled to ten minutes for their presentation; extemporaneous discussion from one person is limited to five minutes at one time.

VI. A member who has once had the floor cannot claim it again until all the others have been heard who desire to speak on that paper.

VII. Members unable to attend a meeting may send discussion in writing of any papers, such discussion to be presented by the secretary under the previous rules.

VIII. Authors may have the last five minutes of the time allotted for a paper and discussion to close the debate.

IX. The time available for papers at every meeting shall be so allotted to the several papers as to secure favorable presentation of them all. At the expiration of the allotted time, the debate on any paper shall be closed and the next paper shall be taken up. Any curtailed discussions may be resumed in order, if time is available after presentation of the last paper on the docket.

This method, which has been adopted by but one other society, and that in England, has proven itself most satisfactory, and one by which able discussion with prepared facts has been secured, and it places absent members on

the same basis as those who are not prevented from attending. In addition to discussing papers presented, the society has adopted an original method of securing discussion and information on special topics, which has proven eminently satisfactory.

It is this: Questions of topics for discussion are printed and sent out in advance of the meeting, and those members preparing written discussion have the precedence in the order in which the secretary is notified. In this manner well-considered opinions on many subjects are presented in very concise form.

The first paper presented was that by Prof. Francis Reuleaux, on "Friction of Toothed Gearing," followed by that of Prof. R. H. Thurston, of Sibley College, Cornell University, on "Friction of the Non-condensing Steam Engine," and discussion of the latter brought out the fact that for practical purposes the friction of an engine could be assumed as constant and as measured by the power required to drive the engine when not loaded.

Prof. Gaetano Lanza's paper on "Strength of Shafting Subject to both Twisting and Bending," was called up and fully discussed, by Messrs. Kent, Doane, Towne, and Henning, which developed the fact that further experimentation in the same direction was highly desirable, and that the general formula used in designing was not in accordance with actual facts.

Prof. George I. Alden, of Worcester Institute, then presented his paper on "Formulæ and Tables for Calculating the Effect of Reciprocating Parts of High-Speed Engines," the able discussion of which by Prof. G. Lanza proved that the formulæ proposed being merely approximations, were not as reliable as some others which were in use, and had been reduced theoretically, representing the actual facts fully and being simpler.

Mr. George H. Barrus' note on "A New Calorimeter," being merely supplementary to his previous exhaustive paper, was not discussed.

As time was available, the "Topical Discussions" were taken up on this second day, and proved highly interesting. "How should a laboratory of mechanical engineering be equipped" was discussed briefly by Messrs. Lanza, Alden, and Towne, and opinion confirmed that it would be best to have existing laboratories working in different fields and avoid duplication of work as much as possible.

"What are the best problems for students in mechanical engineering in the last year of their regular course," was discussed very fully by Messrs. Kent, Lanza, Towne, Partridge, Henning, Languinette, and Alden, and the belief prevailed that the highest problems and methods should be allotted to the last year, after having had thorough elementary training in preceding terms.

The question, "Can you give any data from your own experience as to the power required to drive modern American machine tools?" was such a broad one as to call forth numerous witticisms as well as earnest thought, principally by Messrs. Hobbs, Lanza, Babcock, Kent, Raynal, Ashworth, Towne, Faulkenan, and others, each giving his own experience with machine tools under different conditions.

"What are the best conditions for flying rope for transmission of power: are there limitations to its use?" next followed and was considered from so many views and as adapted to so many purposes that there was great difference of opinion, but the essence of all experience was that wire-rope transmission must be carefully and correctly adjusted to give best results, but when so erected it was highly satisfactory, as explained by Messrs. Hill, Stirling, Robbins, Giddings, Raynal, Hobbs, Towne, and Partridge.

On Wednesday, December 1, an early start was made for Newark by way of Bedloe's Island, where the members climbed to the top of the Goddess of Liberty. At Newark the society, accompanied by a host of ladies, visited Hewes & Phillips' works, where their large ice-machines and tools attracted attention; then an elegant lunch was served by our Newark hosts, after which the U. S. Electric-Light Co's. works, Watts, Campbells & Co's., Clark's Thread Mill, and Mr. Weston's private electrical laboratory were visited, in each which machinery typical of its kind was inspected and admired. The manufacture and testing of electric apparatus were no doubt the principal attractions. Returning to the convention rooms in the evening, Mr. Oberlin Smith's paper on "Intrinsic Value of Special Tools," and that of Mr. W. E. Partridge on "Capital's need of High-priced Labor," were considered. The latter called forth so much comment by Messrs. Hawkins, Kent, Towne, Fowler, Almond, Oberlin Smith, Wallace, and others, that it was made a special topic for the next convention. The general belief expressed was that a satisfactory arrangement could be made between capital and labor, that remuneration would be enhanced, and both parties satisfied.

On Thursday the society met at the Stevens Institute of Technology in Hoboken, N. J., and the session opened by taking up Mr. Benjamin Baker's paper on "Working Stress of Iron and Steel." The discussion by Messrs. Kent, Wood, Henning, and Towne developed the great importance of the subject treated and the valuable results of experiments as given in the paper, also giving additional evidence of the advantage of using steel instead of wrought iron. Mr. Kent's paper on the "Heating Capacity of Water-Gas" was fully discussed by Messrs. Trautwein, Schuhmann, and Taylor, and the deductions obtained were strongly endorsed. Mr. A. C. Campbell's paper on the "Conicograph" explained a beautiful and extremely simple apparatus for drawing any and all of the conic sections correctly and accurately.

Mr. Thomas D. West presented a paper on "Aluminum Bronze," which elicited much inquiry on the part of numerous engineers who were interested in such material.

The topical discussions were resumed after the members had partaken of a lunch tendered by President Henry Morton, at his residence, and an hour had been devoted to an inspection of the Stevens Institute, in which all of the shops and laboratories were in full working order; the freshmen and junior classes were busily engaged, pursuing their work and ready to explain all apparatus to the visitors. The greatest interest was taken in the various shops, and particularly in the apparatus and dynamometers located at different places in the shops, and also the mechanical paradoxes of Professors MacCord and Webb, which riveted the attention all. Unquestionably the electric dynamometer, used to determine the power consumed and electric currents and efficiency developed by dynamos of all descriptions, was the most noteworthy apparatus.

"Is aluminum bronze corroded by exposure to weather, etc.?" was then asked by the chairman, and the several observations went to show that it was almost as unchangeable as gold and platinum.

The old question, "Which do you prefer, a feed-pump or an injector?" was then taken up and answered variously, although the general opinion was given in one word, "both," meaning that two methods should be provided for feeding boilers. Messrs. Wolff, Babcock, Kerr, Giddings, Cole, and Le Van each related their expeiiences in this respect.

In answer to the topic, "What is the best way to separate grit from grinding rooms and prevent its dissemination in yards and shops?" a few sketches of arrangements were shown and several other methods were described by Messrs. Giddings, Dodge, Partridge, and Towne, which had given entire satisfaction.

Another topic was an inquiry into the practical value of the sand-blast process for sharpening old and new files, and Messrs. Trump, Disston, Taylor, Babcock, and Collins all gave their evidence that it was a very superior process, especially when used on new files; they could do 50 per cent. more work than when used as they come from the hands of the cutter.

On Friday the society, numbering nearly 200, of which 50 were ladies, took a special train tendered by the P. R. R., to Trenton, where the extensive establishments of Cooper, Hewitt & Co., New Jersey Iron and Steel Co., Phœnix Iron Co., and C. H. Davis' Pottery were visited, the latter especially giving intense delight to the ladies. At the Hewitt's wire mill the numerous processes employed in making wire of all grades were closely examined by all, and the high-speed Corliss engine occasioned no little surprise. At the works of N. J. Iron and Steel Co., the automatic train for rolling large shapes, especially 20-inch I-beams, was seen in full operation; it is no doubt the best train of its kind in the country. Here also was shown the multiple punch of their own design, by which plates of any length and sixty inches in width can be punched by a spacing carriage of admirable design and great economy.

At the Hewitt mill the entire party was entertained in a most hospitable manner by their generous hosts, who forgot nothing to satisfy the inner man.

After tendering the thanks of the society to the P. R. R. Co., the courteous hosts, Captain Brewerton, U. S. A., the Managers of the American Institute Fair, and Mr. S. W. Baldwin, who had so generously presented the entire valuable collection of apparatus of the late J. C. Hoadley, Esq., of Boston, Mass., to the society, the convention adjourned.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. III.

ERECTION OF THE TOWERS OF ST. PATRICK'S CATHEDRAL, NEW YORK CITY.

(Continued from page 10.)

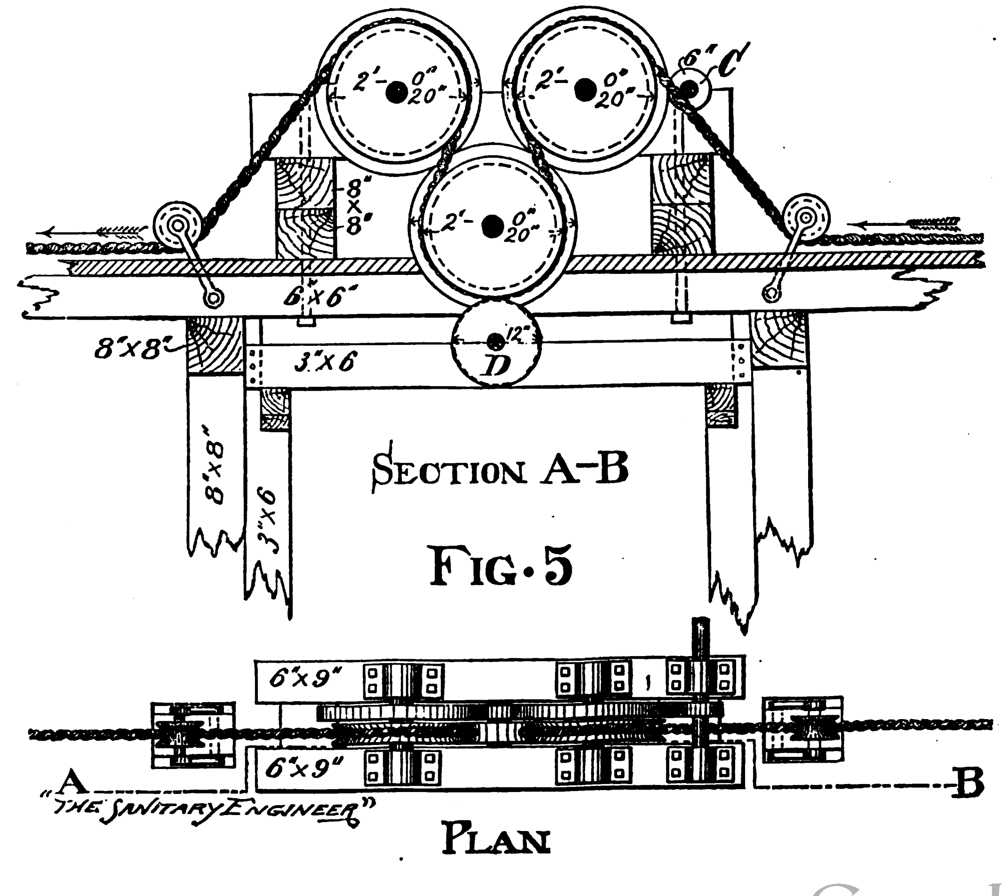
OUR last article completed the description of the main scaffolding at the Cathedral, with the exception of the application of the power to the main hoist. This is shown in Fig. 5. The 6-inch pinion, marked C, is placed on the driving-shaft from the engine, and is geared into the first of the 2-foot wheels, this into the next, and so on. The leading blocks at each side are for the purpose of making the rope grip the grooved wheels on each of the outer wheels and prevent slipping. The small grooved wheel below is on a separate frame, and arranged to be forced up by the folding wedges, shown below, and assist the grip when the rope is wet. It works by squeezing out the moisture after a rain and thus dries the rope quickly. At this point it may be well to state that even for the use of a hemp rope it is altogether desirable that all leading blocks and sheaves be of *large* diameter. Also, that it always pays to turn the grooves smooth. All kinds of rope will wear much longer where these precautions are taken.

The engine has two 8x12-inch cylinders, with a link motion for reversing.

The speed of hoisting is but about 50 feet per minute, but, as this is unnecessarily slow and there is an abundance of power in the engine, a new drum is to be put in place for next season's work, which will give a speed of about three feet per second.

A wire rope is also to be substituted for the hemp rope, as the later from absorption of moisture is constantly changing length and requiring frequent adjustment to bring the platforms to the right elevations.

After the stone has reached the top of the work it is picked up by the setting-derrick. (See Fig. 6.) This consists of a horizontal boom of two 3x10-inch sticks at each end, spaced 4 inches apart, bolted to oak distance-blocks at the ends and to a solid 10x10-inch stick at the centre. It is trussed by two ⅝-inch rods, with turnbuckles each side of the centre for adjustment. The trolly is arranged for a double purchase, and the load is run in by slacking off on the rope leading from the trolly to the fixed sheave in the "outboard" end of the boom. The hoisting-rope is led to a fixed sheave in the inboard end and thence to a hoisting-drum 4 inches diameter, with gearing and crank for hoisting. The braces from the middle point of the boom arms lead to a compound strap working freely in the groove of a cast-iron collar, all shown in detail. The straps at the lower ends of the braces are twisted one-quarter round so as to be attached to the lugs on the cast portion of the compound straps by ⅞-inch bolts. The two cast portions, 1x3½-inch, of the



SECTION A-B

FIG. 5

PLAN

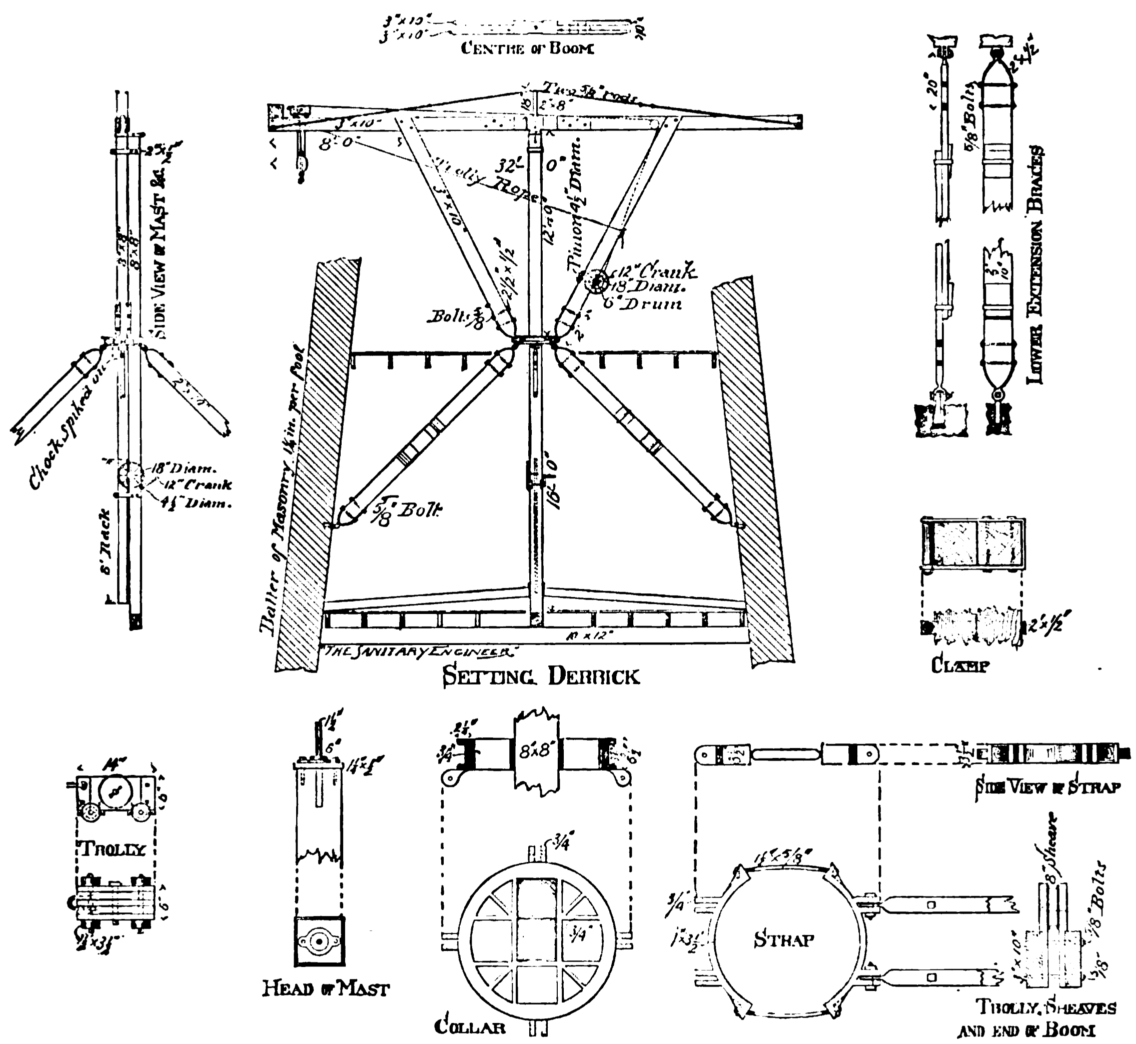


FIGURE 6.

strap are joined by wrought straps, ⅝x1¾-inch, the ends of the latter being forged to a round and having threads and nuts for tightening. The lugs at the ends of the cast portions have strengthening flanges at top and bottom. The collar has one section cast 8x16 inches so as to allow two 8x8-inch sticks to pass through freely. It slips over the two, as shown, and has a chock spiked on the boom below it to take the weight when the lower braces are thrown out of use while raising the derrick.

The upper braces are notched one inch on the booms. The lower braces are compound and have straps of 2x½-inch iron at top and bottom, with eyes for attachments. At top they are fastened by bolts to lugs cast on the lower angle of the collar and at the bottom to lewises fixed in the masonry. They are lengthened or shortened by sliding the two parts past each other, and are fixed by a wedge and strap near the end of each portion.

The subsidiary stick at the side of the mast serves the double purpose of stiffening the mast, and hoisting it. For this purpose a rack 8 feet long is let into the face of the mast next the other stick, into which a pinion which is attached to the subsidiary stick is geared. On the same shaft is a spur-wheel operated by a pinion and crank. At the top of the second stick is a band with lugs to which temporary guys can be attached. This being done and the bottom of the stick supported and braced, the derrick can be raised bodily nearly the length of the rack. It is then supported, and the compound braces fixed in position, as also a second set of ordinary braces at the extreme lower end of the mast, after which, by reversing the motion of the lower crank, the subsidiary stick can be hoisted and supported. The two sticks are kept in position laterally, respecting each other, by two straps of 2x½-inch iron surrounding the two and bolted to the mast. To make the motion smooth while raising, a 2-inch roller bears against the further face of the mast.

The trolly is made up of three oak boards 1 inch thick bolted to distance pieces at the ends. The bearing wheels under it are 1¼x3½ inches, and they run on 1½x1½-inch angle-iron tracks spiked to the top of the boom.

(TO BE CONTINUED.)

CHIEF CLERK YOUMANS has made a report to the Secretary of the Treasury upon the improvement of the sanitary condition of the Treasury, recommending the adoption of the plans of Mr. Robinson, Inspector of Plumbing of the District, for the improvement of the plumbing of the building.

THE SCOPE OF THE CHICAGO INVESTIGATIONS ON SEWERAGE AND WATER-SUPPLY.

THE Chicago *Tribune* of November 30 contains a report by Rudoph Hering, C. E., on the progress of the investigations making under his direction on improved sewerage and water-supply for Chicago. We quote the the following paragraphs, as they give an idea of the scope of the work necessary:

"The examinations which are being made may be grouped as topographical, hydrographic, and office work. The first consists in the making of surveys and soundings by which to estimate the probable expense of a new and more spacious water-way between Chicago and Joliet by enlarging the Illinois and Michigan Canal, or by following the valley of the old Mud Lake and the Desplaines River. Surveys were also required with a view of establishing circulation in the now stagnant South Fork, and to examine into the practicability of diverting the flood-water of the Desplaines River and of the North Branch into Lake Michigan through the town of Lake View and thus to prevent the Chicago River from discharging into the lake at any time. The area of the Desplaines basin had to be measured and the river-bed examined in order to ascertain the quantity of flood-water to be expected. A general topographical reconnaissance was made of the towns adjoining the city in order to judge of the effects which their future requirements for sewage disposal and water-supply might have on works proposed for Chicago, and *vice versa*. A close inspection and some surveys were necessary of the land most suitable for sewage filtration.

"The hydrographic work consists in studying the nature of the currents in the lake to determine the best points at which clarified sewage could be discharged if necessary and the effects thereof, and at which a water-supply could be obtained that would be secure against pollution and against being roiled in stormy weather, and also one that would have a minimum temperature during the summer months. It consists further in gauging the fluctuations of the lake and the Chicago River to determine certain elements of discharge of the latter at present and in the future should it be diverted into the Desplaines River. Gaugings were also required of the flow of the latter, and records were needed of the rainfall over its water-shed for the purpose of studying the laws of its flood discharges. The hydrographic work finally includes an examination into the extent to which the Chicago River and its branches are at present being polluted by sewage and by manufacturing and other refuse.

"The office work besides including the compilation and examination of the results of the topographical and hydrographic surveys, comprises a study into the most economical collection and distribution of the water supplying the city, and of securing a high-pressure service in the business district; into the character and location of intercepting sewers; into the general questions relating to the sewage disposal into the Desplaines River, on filtration areas, or into the lake; the making of comparative estimates of cost, etc. At present it is estimated that more than one-half the work, as outlined above, is done. A large mass of material has been collected and is being worked up and put into proper form for comparison."

DOMESTIC PLUMBING, HEATING, LIGHTING & VENTILATION ENGINEERING

TRAP-SYPHONAGE.*

THE experiments on trap-syphonage made by S. S. Hellyer, of London, and similar experiments conducted by Philbrick and Bowditch, of Boston, clearly proved the utility of trap-ventilation. The experiments of George E. Waring, of Newport, and J. Pickering Putnam, of Boston, as clearly (apparently) proved the uselessness of such ventilation. In the preparation of a work on plumbing I found this conflict of authorities very perplexing. In fact, it was impossible for any one to form a definite conclusion on the efficiency or inefficiency of trap-ventilation without actual experiment. The difficulty and the object to be attained were laid before Dr. J. Mills Browne, Medical Director United States Navy, in charge of the Museum of Hygiene at that time. Upon consulting with the Surgeon-General of the Navy the subject was thought of sufficient importance to have a system of iron and lead pipes with fixtures erected outside of the museum building. With these pipes I have been conducting experiments from the fall of 1885 to the present time, as opportunity would permit. The waste and vent pipes are of the sizes used and arranged as in common practice. The traps on which the tests were made were selected so as to cover the different kinds in the market, both mechanical and non-mechanical. The apparatus is so arranged that the fixtures can be subjected to a strain equal to what they would receive in actual use, as well as strains more severe than they would have to withstand, except in unusual contingencies.

The points or places of inspection, and for the attachment of traps, are platforms located on the first, second, third, and fourth stories, as shown in the drawings attached hereto. By this arrangement the effect of water discharged from varying heights can be thoroughly tested in their relations to the different stories of a building. There is a marked change in the effect produced in different stories of a building by a discharge of water from the same point.

The main stack of pipe is of 4-inch extra heavy cast iron, starting at a connection with the sewer (branches, valves, and connections being inserted at the proper points) and running thence a distance of 32 feet horizontally, and 42 feet vertically, to a point above the roof of the building. In the second story there is an auxiliary stack of 4-inch lead pipe connected with the iron pipe and running to a point above the roof. Both the iron and lead pipes have running-traps and fresh-air inlets near their point of commencement, with valves and screw-plugs, by which they can be partially or completely closed as desired. By means of a Y-branch the system can be made to empty into the sewer without passing through the running-trap. Either outlet can be used at pleasure, both being governed by gate-valves. Two stacks of 3-inch vent pipe (one lead, the other iron) run vertically from the second story to the roof, thence horizontally along the roof. By means of plugs and valves the lengths of the vents may be varied from a few feet to 42 feet and the openings from 0 to 3 inches. The outlets in both the soil and vent pipes are so

*"Report on Experiments in Trap-Syphonage at the Museum of Hygiene, U. S. Navy Department, Washington, D. C." A paper read before the American Institute of Architects at the twentieth annual convention in New York, December 1, 1886, by Glenn Brown, architect.

arranged that traps from 1¼ to 4 inches can be attached at pleasure, all outlets not in use being cut off by gate-valves or screw-plugs.

Syphonage, caused by the discharge of water through the trap itself from a fixture above, has been found of very little consequence. Syphonage rarely takes place, the water passing over the long arm of the syphon rarely fills the pipe so as to cause the necessary vacuum. When it does take place, the trap fills by the drainage from the fixtures above, such as the wash-basin or sink. The back pressure which comes from sewers would never force the seal of a trap in a house plumbed according to modern practice, the fresh-air inlet and the top of the soil-pipe being always left open. The greatest danger arises from the discharge of large bodies of water down the long vertical 4-inch pipes. This column acts to a certain extent like a piston, compressing the air in front of it and creating a vacuum behind it. The air rushing in to fill the vacuum forces or draws the water from the traps into the soil-pipe, while the compressed air finds its easiest mode of escape through the traps below the point of discharge, even when there is a fresh-air opening between the running-trap and the house. Although the water, in case of back pressure, is driven up into the pipe or fixture above the trap and then returns to the trap, *the sewer-air passes into the house.*

The majority of the experiments have been made to test the power of traps to resist the syphonage and back-pressure produced by the column of water passing down the vertical pipes. The question of first importance is: *Does ventilation protect the seal of traps in ordinary use?* This question is answered by the following experiments, in all of which the vent-pipes were open, and a positive effort was made to break the seal of the trap. In the first experiment the fresh-air inlet at the foot of the soil-pipe and the opening at the roof were closed, in this way subjecting the traps to the greatest strain which they could possibly have to resist for either syphonage or back-pressure:

EXPERIMENTS.

No. 1. A 3-inch lead trap was attached to the outlet in the second story and the water discharged from the tank in the fourth story through a 4-inch opening; the column of water passing down the vertical pipe a distance of 30 feet before it reaches the branch to which the trap is attached; the air confined in the 4-inch pipe between the running-trap and the water column was forced out with considerable violence through the vent-pipe; the outlet of vent in trap was 2 inches in diameter and ran into a 3-inch vent-pipe, which extended up above the fourth story; a discharge of 15.5 gallons created a slight commotion in the trap, from a sixteenth to an eighth of an inch, splashing out when the trap was full.

No. 2. The same discharge, same condition (except the small amount of water shaken out of the trap), no effect.

No. 3. Same as No. 2.

No. 4. A 1½-inch trap was connected at the same point, the 3-inch lead pipe being removed, inch vent-pipe open, 15.5 gallons discharged from the tank; water only shaken a little; none thrown out.

No. 5. Same conditions; 7.75 gallons discharged through 4-inch opening in tank; no effect on the seal of trap.

No. 6. A discharge of 15.5 gallons through 2-inch opening in tank; no effect on the seal of trap.

No. 7. Same as No. 6.

No. 8. Same as Nos. 6 and 7.

The fresh-air inlet was now opened and the following experiments tried:

No. 9. Sanitas trap attached; 7.75 gallons discharged through 4-inch opening; no effect on seal.

No. 10. Same as No. 9.

No. 11. Same as Nos. 9 and 10.

An opening was now left near the top of the soil-pipe, a practical illustration of an open fresh-air inlet and top of soil-pipe, and the following experiments tried:

No. 12. A 1½-inch lead trap was attached at the same point; 15.5 gallons discharged through the 2-inch opening of the tank; no effect on the seal of trap.

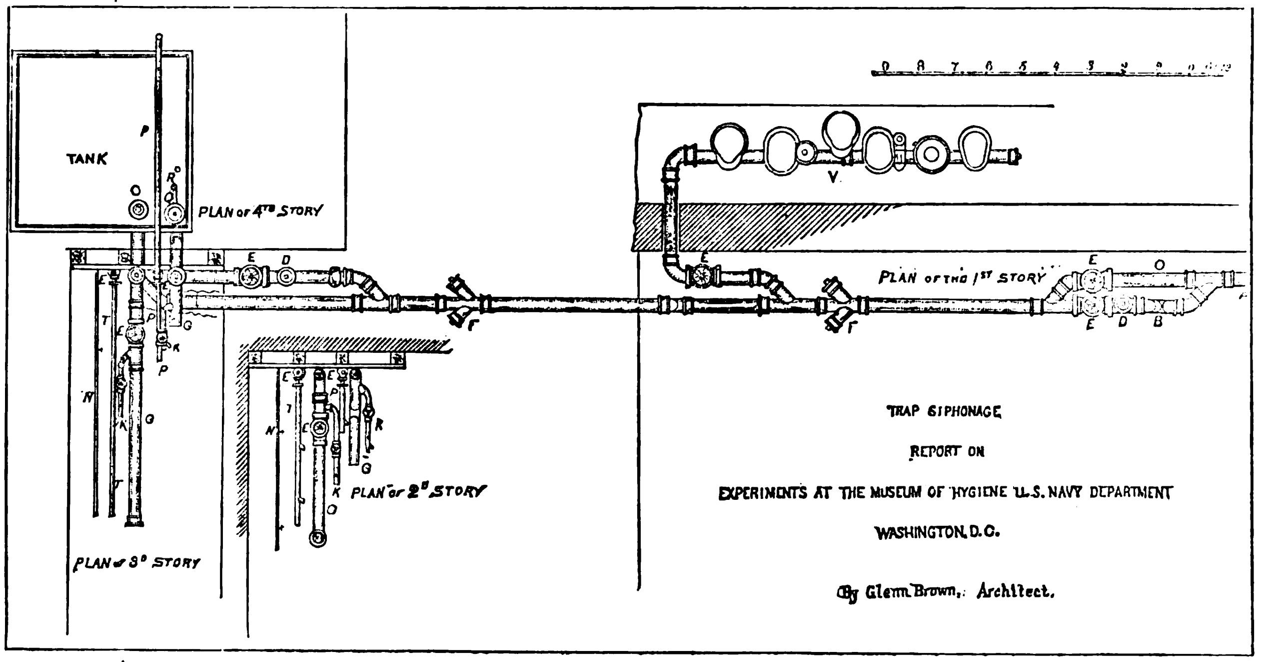
No. 13. Same as No. 12.

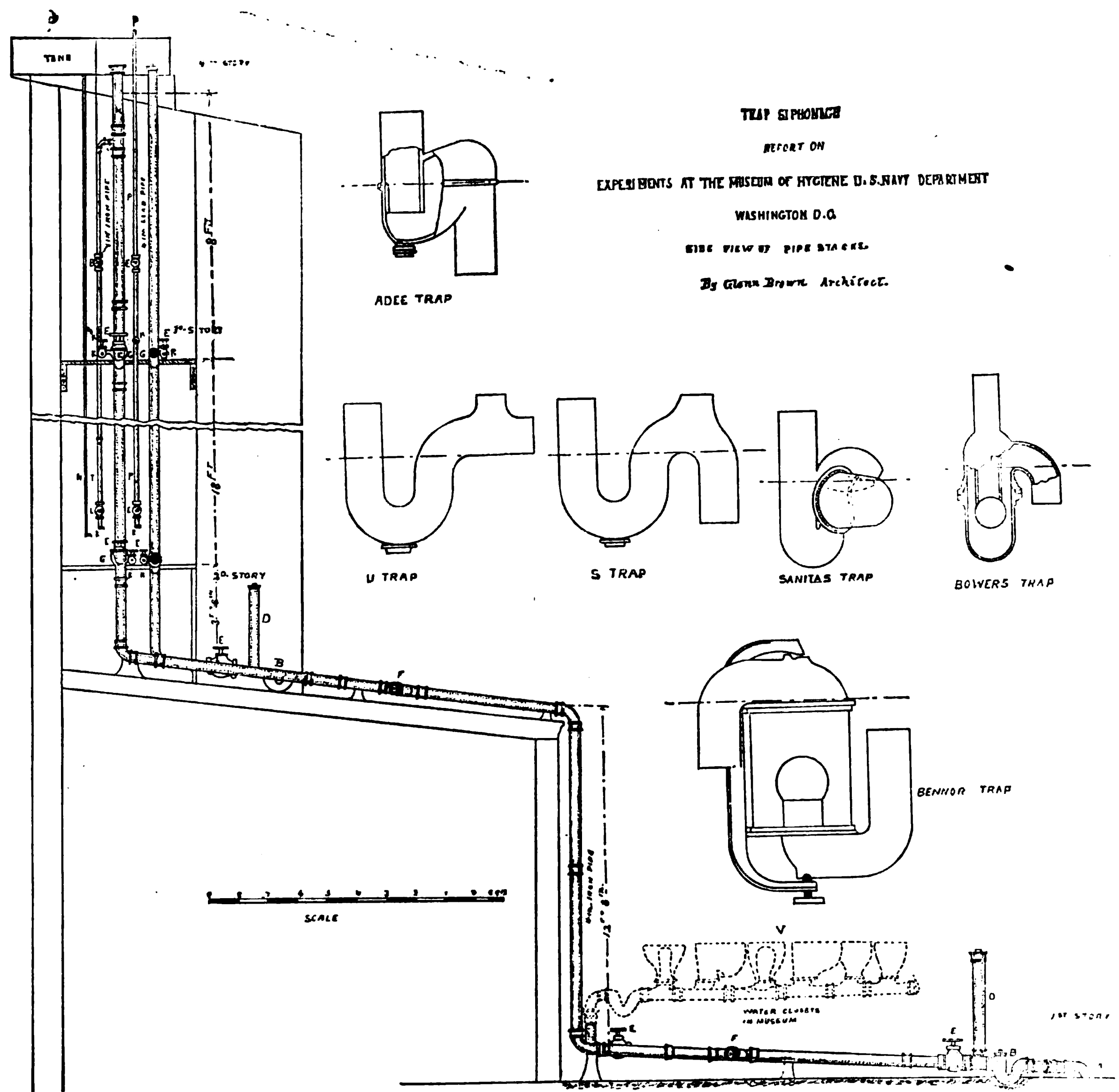
No. 15. Fred Adee's 1¼-inch trap was connected at the same branch of the soil-pipe. One-inch discharge of 15.5 gallons through the 2-inch opening of the tank. No effect on the water-seal of the trap.

No. 16. Same condition; same effect.

The point of experiment was now transferred to the third story and the traps attached at that point, the discharges being made from the same tank on the fourth story.

No. 17. A 1¼-inch Bennor's trap was connected with the branch from the main soil-pipe; discharge of 15.5 gallons through the 4-inch opening in the tank. No effect on the seal of the trap.





EXPLANATION OF ILLUSTRATIONS.

A—Entrance to sewer.
B—Running-trap.
C—Direct outlet to sewer.
D—Fresh-air inlet.
E—Gate-valves.
F—Double Y's.
G—Four-inch branches.
K—Two and three inch branches.
N—Supply-pipe.
O—Four-inch iron opening in tank.
T—Lead vent-pipes.
P—Lead vent-pipes.
Q—Four-inch lead opening in the tank.
R—Two inch opening in the tank.
V—Water-closets in the first floor of the Museum.

The drawing shows the plan of second story detached; otherwise it would be hidden by the third story.

The views of traps are enlarged, the dotted line showing the water-line.

No. 18. A small 1¼-inch S-trap was inserted; the same discharge and the same effect.

No. 19. A 4-inch S-trap was connected. Same discharge; same effect.

The following experiments were made with vents more or less closed:

No. 20. A 4-inch S-trap. The outlet to vent was half closed. There was considerable commotion in the trap, but the seal was not in any way affected by 7.75 gallons discharged from the tank through the 4-inch opening.

No. 21. Same experiment; same effect.

No. 22. The outlet of vent was three-quarter closed, and a discharge of 15.5 gallons was let out of the tank. There was a great commotion in the trap, the water being lowered until only a quarter of an inch seal remained.

No. 23. The 4-inch lead S-trap in position; the top of vent-pipe half closed; no effect from 7.75 gallons discharged through the 4-inch outlet in the tank.

No. 24. The same trap; outlet of vent quarter closed; one discharge from tank through the 4-inch opening in the tank; water lowered five-eighths of an inch in trap.

No. 25. Same as No. 24.

No. 26. The same trap; the top of vent half closed; one discharge of 15.5 gallons through the 2-inch outlet of the tank. The water was lowered five-eighths of an inch.

No. 27. Same as No. 26.

No. 28. Same as Nos. 26 and 27.

No. 29. Same trap; same vent half closed; 15.5 gallons discharged through the 4-inch outlet of the trap. The air was drawn through the trap and 2 inches of water taken out. The seal was not broken. The trap was refilled.

No. 30. Same as No. 29.

No. 31. Same as No. 29.

No. 32. One discharge of 7.75 gallons, the top of vent being seven-eighths closed and the trap was syphoned.

No. 33. Same as No. 32.

No. 34. Same as Nos. 32 and 33.

A question of equal importance is, *are unventilated traps syphonable or are some varieties syphonable and others not so?* If some are unsyphonable and at the same time not affected by back-pressure it is important to know which they are. The following array of facts will answer the question:

In the following experiments the vent-pipe was closed, unless otherwise noted. The first tried were with the topof soil pipe open and the fresh-air inlet closed.

No. 35. A 3-inch lead S-trap was connected to one of the branches on the second story, and 15.5 gallons was discharged from the tank in the fourth story through the 4-inch opening. The confined air in the pipe between the running-trap and the descending column of water was forced through the trap, carrying the water with it. This passage of air continued as long as the water was flowing through the pipe from the tank.

No. 36. Same discharge from the tank. A small amount of water was blown out by back-pressure; then the trap was syphoned to 1¼-inch below the seal of the trap.

No. 37. Same as No. 36.

No. 38. Same as Nos. 36 and 37.

No. 39. Twenty-three gallons were discharged through the 4-inch opening in the tank. The water was thrown up above the trap by back-pressure, playing above the trap like a fountain, a large part of it falling back into the trap, after which syphonage took place, as in experiment No. 36, leaving an eighth of an inch seal in the trap.

No. 40. A 3-inch lead S and a 3-inch lead U and a 1½ Sanitas trap were all attached to the same branch on the second floor; 15.5 gallons were discharged from the tank on the fourth floor through a 4-inch opening. The two lead traps were syphoned and half the water taken out of the Sanitas trap.

No. 41. Same as No. 40.

No. 42. Same as Nos. 40 and 41.

No. 43. The two lead traps were then cut off and the discharge sent through the pipe; the Sanitas S-trap was two-thirds emptied.

No. 44. Similar discharge without the trap refilling. The Sanitas trap was syphoned, only an eighth of an inch being left in the trap.

No. 45. A small 1¼-inch S-trap was inserted at the same place; 15.5 gallons discharged through the 4-inch opening in the tank. The trap was syphoned.

No. 46. The same trap was removed to the second floor and 15.5 gallons discharged through the 2-inch opening in the tank. The water was blown out of the trap.

No. 47. Same as No. 46.

No. 48. Same as Nos. 46 and 47.

The following experiments were made with the top of the soil-pipe and the fresh-air inlet both open, making a system of pipes the same as are now most commonly used in our houses:

No. 49. A large 4-inch S-trap and a 1¼-inch Bennor's trap were connected with the soil-pipe branch in the third story; 15.5 gallons discharged through the 2-inch opening in the tank. The Bennor's trap was not affected, while the 4-inch S-trap was completely syphoned. In this case the S-trap formed a vent for the smaller trap.

No. 50. The S-trap was removed and the same discharge made. The water was completely drawn out of the glass cylinder of the Bennor's trap.

No. 51. Another similar discharge without refilling the trap, and the seal was broken. The water would be drawn by syphonage beyond the ball into the cylinder, when the ball would take its seat, and the water would not pass back into the lower part of the trap. This shows the ball to be effective against the back-pressure in a new trap of this make.

No. 52. A Sanitas trap was put in at the same place; same discharge as above. Half of the water was taken out of the trap. The air passed out of the trap rapidly, creating a continuous commotion in the water. The bulk of the water seemed to be thrown out against the separator in this trap and to fall back without passing out.

No. 53. Same trap; same discharge, one-eighth of an inch being extracted.

No. 54. Same as No. 53.

No. 55. A 1½-inch lead S-trap, Bower's 1¼-inch trap, and a 4-inch lead S-trap, all connected at the branch in the third story; a discharge of 15.5 gallons through the 2-inch opening in the tank. The Bower's trap was lowered to within a half-inch of the seal, the small S-trap to within one inch of the seal, and the large S-trap to within two inches of the seal.

No. 56. Same discharge; the S-traps not affected. A small amount of water drawn from the Bower's trap. The traps were not refilled.

No. 57. Same discharge; same effect on the S-traps. The Bower's trap was lowered to within an eighth of an inch of the seal. As soon as the air began to pass freely through the Bower's trap it acted as a vent for the two S-traps, the air finding its way into the soil-pipe.

No. 58. The small S-trap was removed and 15.5 gallons sent through the pipe from the 2-inch opening in the tank. The Bower's trap not having been refilled, was lowered to the seal; the air passing through it formed an excellent vent for the large S-trap.

No. 59. Same experiment, the Bower's trap partly closed; the S-trap was immediately syphoned, the seal being broken.

No. 60. Same as No. 59.

No. 61. The 4-inch S-trap in same position. The vent was connected with the 3-inch vent-pipe, 20 feet long, closed at the top; 7.75 gallons disharged through the 4-inch opening in the tank. The trap was syphoned, seal being broken, the elasticity of the air in the long vent-pipe having no effect in preventing syphonage.

No. 62. Same as No. 61.

No. 63. A 3-inch lead S-trap was attached to a double Y on the second story; 15.5 gallons were discharged through the 4-inch outlet of the tank, the running-trap was cut off, and direct outlet to sewer used. Half an inch was blown out of the trap; the trap was not refilled.

No. 64. Same discharge. A quarter of an inch was blown out by back-pressure.

No. 65. Same discharge; one-eighth inch more blown out of the trap.

The following experiments were tried with the top of soil-pipe and fresh-air inlet closed:

No. 66. The Sanitas trap was attached to the outlet in the second story; 15.5 gallons were discharged through the 2-inch outlet in the tank; the seal of trap was destroyed by the back-pressure.

No. 67. Same as No. 66.

No. 68. Same as Nos. 66 and 67.

No. 69. Same trap; 7.75 gallons were discharged through the 4-inch outlet of the tank; water first blown out of trap, then taken out by suction.

No. 70. Same as No. 69.

No. 71. Same as Nos. 69 and 70.

The following experiments were tried with the top of soil-pipe closed and the fresh-air inlet open:

No. 72. A large 4-inch S-trap was inserted in the third story, a Bennor's trap in second story, and 15.5 gallons discharged through the 4-inch opening in the tank. The seal of the 4-inch trap on the second story was broken, while the seal of the Bennor's trap on the first floor was not affected.

No. 73. Same as No. 72.

No. 74. Same arrangement of traps; 31 gallons discharged through the 4-inch opening in the tank. The S-trap syphoned, ¼ inch drawn out of Bennor's trap S-trap refilled.

No. 75. Same arrangement of traps; 15.5 gallons discharged through the 4-inch opening in the tank. The S-trap syphoned, ½ inch drawn out of Bennor's trap, S-trap refilled.

No. 76. Same conditions. The water would rise slowly, the ball moving perceptibly until it passed over the top of the outgo, a small amount at a time. The vacuum in branch on the second story seemed to be caused by the friction of the column of water passing the branches, as it syphoned before the water-column passed the branch.

No. 77. A 1½-inch Sanitas trap was attached to the branch in the third story, and a discharge of 15.5 gallons through the 4-inch openings in the tank. Half of the water was taken out of the trap.

No. 78. Same trap; same conditions. Twenty-seven gallons were let out by accident, and the trap was lowered three-eighths of an inch below the seal.

No. 79. Trap was not refilled; 15.5 gallons discharged; one-quarter of an inch drawn out of the trap.

No. 80. Same trap; same discharge; one-quarter of an inch taken out of the trap.

No. 81. Same as No. 80.

No. 82. Same as Nos. 80 and 81.

No. 83. A 1¼-inch Sanitas trap was put in the same place; a similar discharge. The water was drawn completely out of the trap, leaving only a tablespoonful.

No. 84. Same conditions; 7.75 gallons discharged through the 2-inch opening in the tank; same effect on the traps.

No. 85. Same trap was attached on the second story and 7.75 gallons discharged through the 4-inch opening in the tank; half the water was blown out.

No. 86. Same discharge; half the remaining water was blown out.

No. 87. Same discharge; only a sixteenth of an inch left in the trap.

No. 88. Same trap; same conditions; 15.5 gallons were discharged; three-quarters of the water was blown out of the trap.

No. 89. Same discharge; the whole amount of water was blown out, leaving only a trace.

Fresh-air inlet closed; top of the soil-pipe open:

No. 90. A five-inch lead S-trap was attached on the horizontal pipe on the first or ground floor, and Dececo, Boyle, Zane, and Myers closets were discharged simultaneously with no effect on the trap.

No. 91. Six closets were discharged simultaneously with no effect on the trap.

No. 92. Small S-trap was inserted; no effect.

No. 93. Same as No. 92.

No. 94. Discharged 15.5 gallons from the tank; a small amount of water was blown out of the trap.

No. 95. Same as No. 94.

No. 96. Small S-trap was inserted in the second story and closets on first story discharged; no effect on the traps.

No. 97. Same as No. 96.

No. 98. Small lead S-trap in the third story and water-closets discharged on first story; no effect on the trap.

No. 99. Same as No. 98.

RECAPITULATION.

The Vent-Pipes on Trap Open.—In experiments No. 1 to No. 9, the top of the soil-pipe being closed, the only means of ingress for air to fill the vacuum is through the traps or their vents. This is the most severe test to which the traps can be subjected for syphonage. The fresh-air inlet being closed, the air in the pipes between the down-coming water and the running-trap must necessarily find its way out through the running-trap or through one of the traps connected with the soil-pipe. A strong current of air did in every case pass outward, through the vent-pipe. Such strains would never occur in actual work, unless the soil-pipe and fresh-air inlet should happen to become stopped. This is of rare occurrence in the top of the soil-pipe, sometimes happening from collections of snow or frost. The fresh-air inlet, as it is generally put in, may

be easily closed by earth or dirt collecting on the perforated or grated opening. Experiments from No. 9 to No. 11: The fresh-air inlet was open; back pressure was not great, while the syphon effect was the same. The condition of experiments from No. 11 to No. 34 were what would exactly have to be encountered in actual practice. The simple lead S-trap is acknowledged by all to be the trap which is the most easily syphoned. It will be seen by referring to the experiments from No. 1 to No. 34, that in no case was I able to syphon or force by back-pressure the seal of an S or any other kind of trap when it was properly vented. From that I conclude, that

Traps, when Properly Ventilated, are not Syphonable.—It has been asserted that when the vent is placed on the crown of a trap that in time it becomes choked up by refuse matter adhering to the surface. In these experiments the vent has been put in different positions, and it makes no difference in its effectiveness as long as it is between the trap and the vertical soil-pipe. With a little care the Y can be so placed and shaped that matter passing through the pipe would not adhere to the vent.

Experiments from No. 20 to No. 34 were tried with the vent on roof more or less closed. By these, it can be seen that a vertical vent-pipe less than three inches, when the trap is connected with the 4-inch soil-pipe, causes a commotion in the trap, and a pipe of half its area with a discharge from the tank through a 2-inch opening in the tank drew five-eighths of an inch out each time. This discharge was no greater than would come from a bath-tub. The trap was completely syphoned when the outlet was seven-eighths closed, with a discharge equal to three plunger closets.

When the Vents were Closed.—From No. 35 to No. 99. All traps failed from either syphonage or back-pressure. The experiments from No. 35 to No. 48: The top of the soil-pipe was open and the fresh-air inlet closed, in this way submitting the traps to the most severe strain they would have to withstand from back-pressure. Every trap failed, except the ball-traps.

Experiments from No. 49 to No. 65, inclusive. The soil-pipe and fresh-air inlet being open were similar to the action traps would receive in every-day use. In every case the traps failed or syphoned, except the Sanitas.

I would call special attention to several experiments, No. 49 to No. 59. The discharge being 15.5 gallons through the 2-inch opening in the tank was hardly as severe on the trap as a discharge from a bath-tub. In every case except that of the Sanitas the traps failed.

In No. 49 a 4-inch trap similar to a hopper-closet trap and a small wash-basin; Bennor's trap, a combination often found in bath-rooms, and a large S-trap were syphoned by a discharge no greater than would come from a bath-tub in a story above. Such traps will always be used, and should never be put in without vent-pipes.

No. 55 to No. 60. Intended to represent a water-closet, wash-basin, and bath-tub connection, water extracted from traps at each discharge, and the Bowers' trap acting as a vent, the water was taken out to the seal at the third discharge. The wash basin or bath-trap was then partly closed, as would happen in actual use, by the plug, and the S-traps were syphoned by a discharge no greater than would come from a bath-tub in the fourth story.

Experiments Nos. 66 to 71, inclusive, were more severe than such traps would be subjected to, except in unusual contingencies—*i. e.*, the stoppage of the two air-inlets. All failed. These tests were no more severe than ventilated traps were subjected to.

In the experiments from No. 72 to No. 89, inclusive, the syphon action was greater than actual practice, while the effect of back-pressure would be less, the air confined between the running-trap and the soil-pipe saving free escape through the fresh-air opening.

No. 85 to No. 89 show how the air in the soil-pipe was forced through the trap. All the traps failed.

Experiments No. 90 to No. 99 were with discharges into a horizontal pipe on the ground floor. The traps were not affected, although the vents were closed.

No. 94 to No. 95. Water discharged from the tank in the fourth story blew the water out of the trap.

Back-pressure seems, from the experiments, to be a more important feature in plumbing than is generally supposed. Although the fresh-air inlet was open, the air confined in the pipes almost invariably found egress more easily through traps on second and first floors than through the opening near the foot of the soil-pipe. No trap withstood back-pressure better than the others.

DEDUCTIONS.

(1.) The seals of ventilated traps are safe against syphonage and back-pressure.

(2.) The seals of unventilated traps are never safe from syphon action or back-pressure, except in deduction four.

(3.) The vertical vent should be three inches, with a 4-inch soil-pipe.

(4.) Traps connected on a horizontal pipe and fixtures discharging on the same level into horizontal pipe apparently have no effect on unventilated traps.

(5.) All varieties of non-mechanical traps are more easily affected by back-pressure than by syphonage.

(6.) The ball-traps were not affected by back-pressure, but by syphonage.

(7.) The Sanitas trap withstood syphon action better than any of the patent traps, but was easily affected by back-pressure.*

(8.) The sewer-air is more liable to enter unawares by back-pressure through the seal of the trap, because the seal remains unbroken.

(9.) Difference in friction of iron and lead pipes made no apparent difference in the effect on the traps.

The experiments will be continued as to other matters of moment.

Experiments have been made on evaporation of water in traps and the different methods of testing soil-pipes for leakage; but the matter is not yet sufficiently complete to put in this report. Very respectfully,

GLENN BROWN.

To T. J. TURNER,
Medical Director, U. S. N., in Charge Museum of Hygiene, Bureau of Medicine and Surgery.

*Pot-traps were not experimented on, although their anti-syphon action is known to be good. Being collectors of filth, it is not thought desirable to use them under any condition, and sewer-air would be driven through them by back-pressure with the same ease with which it is driven through other traps.—G. B.

TESTS OF THE EFFICIENCY OF STEAM-BOILERS.

PHILADELPHIA ENGINEERS' CLUB.

AT the meeting on November 20 Mr. John E. Codman presented an account, illustrated by blackboard sketches, of the results obtained from the recent tests of the efficiency of different forms of boilers now in use by the Philadelphia Water Department. The boilers first tested were four in number, and known as "double-decked," a popular form in Philadelphia, and supposed by many to be an economical steam-generator. The lower boiler generally contains about as many tubes as the tube-sheet will safely hold; the upper boiler or drum is connected to the lower one by two or more necks, and the water is usually carried so as to half fill the upper drum. In the trials mentioned the height of water was measured from the bottom of the upper drum. For 16 hours it was kept at 5½ inches from the bottom, and for 8 hours at 12½ inches from the bottom. This difference is not very great, but the results obtained show the advantage of keeping the water as low as possible in the upper drum, as, with high water, much that is obtained is only apparent evaporation. An apparent evaporation of 16,000 pounds of water was obtained per hour for the four boilers, which, when corrected, gave only 16,700 pounds per hour. The calorimetrical tests for quality of steam, made at intervals of 30 minutes, gave over 8 per cent. of water in the steam.

With 5½ inches in the upper drum an apparent evaporation of 16,100 pounds was obtained per hour, which when corrected for steam, etc., gave 17,230 pounds per hour. The calorimetrical tests gave 6¼ per cent. of water in the steam. The evaporation of water per pound of combustible averaged above 9⅓ pounds for the 24 hours. Using 34½ pounds of water from and at 212° Fah. as the equivalent of a horse-power, the low water gives 500 horse-power against 486 horse-power for the higher water. The coal used was an ordinary quality of Schuylkill pea-coal, containing about 16½ per cent. of ashes and clinkers. The second tests were made on the ordinary tubular boiler, set in brick-work and externally fired, arranged so that the escaping gases passed over the top of the boiler and around the steam-drum. The boilers were run for 24 hours, all water and coal being carefully weighed and checked at the end of each hour; the dampers were kept wide open, and all the coal that could be burned upon the grates with a natural draught in a chimney 60 feet high was put into the furnace. The calorimetrical test gave very good results, the average of thirty-nine observations showing $\frac{217}{1000}$ of one per cent. of water in the steam. The evaporative efficiency of these boilers was 10⅓ pounds of water per pound of combustible. The rated horse-power of the boilers was 30 horse-power for each, or 60 horse-power for the two tested. The horse-power developed, using 34½ pounds of water from and at 212° Fah., was nearly 100 horse-power.

Some discussion followed. President Washington Jones said that in the so-called "double-decked boilers" the contracted passages or necks connecting the upper and lower sections, and through which the steam formed in the lower section rises to the upper one with such a high velocity as to carry entrained water, which passes to the steam-pipe and is credited as steam unless the calorimeter test reveals its presence.

This disposition to carry water is augmented by the increased velocity of the ascending steam, caused by the injudicious crowding of the tubes nearly to the top of the lower section, and by insufficient space between the vertical rows, so that the passageways through the necks are thereby obstructed. The better practice is, to omit such tubes as come immediately under the necks, leaving a space of several inches (say one-half the diameter of necks) between the shell at necks and the adjacent tubes, so as to obtain a more quiet liberation of the steam-bubbles. The necks should be of limited diameter, ordinarily from 10 to 14 inches, so that the strength of the shell shall not be impaired by the holes cut in it to match the necks. More than two necks are injurious, as the upper and lower sections should not be rigidly bound together, but should be permitted to alter their parallelism, if unequal expansion demands it. The greater quantity of steam formed at the front, or furnace end, of boiler should establish a circulation upwards through the front neck, and downwards through the back neck. This, however, is evidently not the fact, as the quick and frequent fluctuations of the water-line, shown by the glass gauge, proves. When a volume of steam, greater than usual, is generated in the front end of boiler, the quickened ascent of the current causes a larger quantity of water to flow through the front neck into the upper section, and the water-line rises momentarily at that end of the section, and is so shown by the glass water-gauge; meanwhile, the water is passing down the neck at back end. While the ebullition at front end becomes quieter, and the upward current slower, the water-line falls to a level, or possibly below it, at front end, if the back neck is giving a passage to steam formed at back end of boiler, and so reverses the currents. One requisite of the first importance to the evaporative efficiency of a boiler is the production and maintenance of a constant current of water, passing, without change of direction, over the heated metal surfaces, so as to sweep off the steam-bubbles adhering to those plates, and bringing into their place fresh particles of water to be, in their turn, converted into steam-bubbles.

The secretary announced the death, on October 7, 1886, of Mr. Frank S. Broek, active member of the club.

The secretary presented for Mr. George R. Henderson a "Table of Millimetres and Equivalents in Inches" for the Reference Book.

Mr. Washington Jones, President of the club, was in the chair.

Correspondence.

THE NORFOLK SEWERAGE SYSTEM.

NEWPORT, R. I., December 4, 1886.

SIR: A remarkable claim has been set up by a company assuming to own the patent to Walter S. West, issued in 1872, to make that patent cover all cases of sewage pumping. Its latest performance has been to make a demand, through its attorney, on the city of Norfolk, Va., for $20,000 infringement damages.

The matter is submitted to me by the City Engineer of Norfolk, and I have written him the following letter which may be useful to the authorities of other cities where sewage-pumping is or may become necessary.

Truly yours, GEORGE E. WARING, JR.

NEWPORT, R. I., December 4, 1886.

W. T. BROOKE, Esq., City Engineer, Norfolk, Va.

DEAR SIR: I have your letter of November 30 enclosing documents relating to a claim made by a sewage utilization company to $20,000 damages for infringement of United States patent No. 127,533. Your system of sewerage was constructed according to my plans.

* * * * * * * * *

Supposing this company to be the rightful owner of the patent referred to, it will be seen at a glance that the patent bears no relation whatever to the work that you have constructed.

Patent No. 127,533, issued in 1872, has two claims. The second relates to a certain combination of drains and valves which is not of interest in this connection. The first is, "The system of sewerage consisting of the island-reservoir E and of the drain-pipes B lying at or below the river-bottom, substantially as specified."

In his specification, on which of course the claim is solely founded, the inventor says: "The object of this invention is sufficiently manifest. The foul waters about the river fronts of our cities will be rendered pure. The noisome odors and emanations will be conveyed away to such a distance that they cannot offend. The sewage, instead of being wasted, *will be all utilized to meet the agricultural demand. Vessels can be moored on all sides of the island-reservoir for convenience of loading.*"

He does not confine himself to a reservoir surrounded by water, but he does not otherwise qualify the scope of his invention, which he thus defines:

"It consists in the establishment of a *terminal deodorizing reservoir and manufactory in the channel of the river at a distance from the city*, in the arrangement of the deep-laid pipes laid *under the bed of the river* which convey the sewage to the island-reservoir."

Again, he says: "The deep pipes B pass on a gentle gradient at or below the river-bottom out in the direction of its channel, or some other *distant part of the river easily accessible by vessels, connecting with the reservoir there situated.*"

The specifications say that the reservoir "should be of sufficient size to contain the sewage of the city, *to deodorize and manufacture the same, and to provide wharfage around which vessels may lie to receive the fertilizing material produced.*"

Nothing could be more clear than that this reservoir, of great size, is to be adapted to the deodorization of sewage and to its manufacture into a fertilizer, and that it should be immediately accessible to vessels by which the product may be transported. There is no pretence of the invention of a pumping-well for sewage. In view of the fact that sewage-pumping wells were used before the date of this patent and their construction and use described, it is quite certain that had the inventor claimed to cover such wells his claim would have been rejected.

Your pumping-well being in the interior of the town, remote from any wharf, having its bottom considerably higher than the bed of the river, being in no respect a reservoir, but only a pump-sump, and the deodorization and manufacture of sewage being no part of its object, there is not even an excuse for the advancing of this claim. It may, however, be rendered less surprising by knowledge of the fact that some time ago in endeavoring to secure a concession from a town in New Jersey the company in question stated that the pumping system in use in Boston had been constructed under an arrangement with Mr. West.

Mr. Eliot C. Clarke, chief engineer in charge of the construction of the Boston work, wrote me on this subject in July, 1885, that he had never heard of Mr. West till within a few months—long after the system was completed; that he never heard of a claim that the work was in any respect an infringement of Mr. West's patent being made to any one in Boston, and that no arrangement was made with Mr. West because of his system having been adopted.

Respectfully yours,
GEORGE E. WARING, JR.

TIN PIPE ACTED ON BY WELL-WATER.

TAUNTON, MASS., November 12, 1886.

SIR: I would like your advice on a subject that I have never seen touched on in your paper. I inclose you a sample of block-tin pipe, also one of tin-lined lead pipe, which are a part of a suction-pipe that I placed in a well about six years ago. In about three years I was called to see what the matter was with the pump, and found a leak in the pipe, and took out a piece similar to the one I send you. Since then it has given out several times in the same manner, and I have now taken out the whole line and replaced it with block tin. Now I would like to have your opinion as to whether the trouble was caused by reason of the pipe being imperfect, or whether it is a chemical action caused by certain acids or salts contained in the water, and if the latter, whether, in your opinion, such water is safe for domestic use? The water is soft and agreeable to the taste, and is the only source of supply the family have. It is not in a thickly-settled neighborhood, or near any manufacturing establishments, and the drainage appears to be all right. This is not the first case of the kind that I have met with, and I have heard of several others. I would like your opinion on the subject, and also that of fellow-craftsmen in any part of the country, as it seems to me to be of some importance. Hoping that you may consider this worthy of notice, I remain,

Very truly yours, E. WORDELL.

P. S.—I should have said, perhaps, that the pipe as originally put in was block tin in the well and tin-lined lead from the well to the pump, and I noticed that the pipe that was submerged showed but little signs of corrosion on the outside, but on the inside was continuous and more uniform than in the tin-lined. E. W.

[If our correspondent will refer to the previous volumes of THE SANITARY ENGINEER he will find frequent mention of the subject to which he calls attention.

It is impossible to express any opinion on the character of the water from the information we possess. The fact that it is "soft," however, shows that its action on lead pipes would be more decided than though it were a "hard" water.

We are inclined to think that the trouble was caused mainly, if not entirely, by the imperfect pipes. The piece of block-tin pipe, which shows considerable corrosion on one side, has undoubtedly been subjected to galvanic action, arising from the presence of some other metal in contact with the tin, either as an impurity in the tin itself or as the result of careless manufacture.

The piece of tin-lined lead-pipe does not show so much corrosion over its entire surface, but, in one place, the action has resulted in eating a hole in the pipe. The exposure of the tin and lead in contact to the action of the water would naturally result in a more rapid destruction of the metal, in consequence of the more favorable conditions for galvanic action. It has been observed that manufacturers of this pipe are sometimes not sufficiently careful to prevent the alloying of the tin with the lead, so that what was intended as a means of preventing the solution of the lead by the water may, in some cases, become the means of promoting it.

Further information on this subject will be found in THE SANITARY ENGINEER, Vol. VIII., 561, 587, 608; Vol IX., 13, 66; Vol. X., 122; Vol. XI., 458.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
December 4....	24.89	20.42	21.72	30.06	28.97	23.14	31.47

E. G. LOVE, Ph.D., *Gas Examiner.*

A WESTERN paper mentions the invention of a new process for manufacturing gas. The machine consists of a "system of syphons, and air is forced alternately through water and through oil, resulting in gas." Beautiful gas this must be. The inventor claims to get 450,000 cubic feet of gas from a barrel of oil. As the "gas" consists principally of air, there seems to be no good reason why the inventor should place his yield at so low a figure. Another amusing feature of this invention is that the residue of oil in the barrel is worth as much for lubricating purposes as the original barrel of oil. The paper states that "representative chemists from Harvard College" have reported favorably upon the invention. No wonder the inventor "was given $1,000,000 for the right in the United States," etc.

THE electric-lights which were placed at the entrance of the Dardanelles are said to be so satisfactory that the system is to be extended to other points on the channel.

THE *Lancet* says: "The Works and General Purposes Committee of the Metropolitan Board of Works has been good enough to agree with a Select Committee of the House of Commons in the opinion that something should be done about the overhead wires of the telegraph and telephone systems." From what the English journals say on this subject it is clear that London needs underground wires quite as much as New York does.

FORTY-TWO applications have been received for the position of accountant and secretary to the Toronto Water Board, the salary offered being $1,200 per annum. A short list of candidates is being prepared.

THE NEW ENGLAND WATER-WORKS ASSOCIATION.

THE New England Water-Works Association held its quarterly meeting at the Quincy House, Boston, Wednesday, December 8, at which about forty members were present. There were no set papers, but there was an abundant flow of informal discussion, and a highly interesting and satisfactory meeting was the result.

Dinner was served at 1:30 P. M., at which President Rogers, of Lawrence, had Alderman Pettee, of Newton, on his right and Secretary Glover on his left, and without special order the following gentlemen on either side: Messrs. Rotch, of Boston, Coggeshall, of New Bedford, Allen, of Hyde Park, Billings, of Taunton, Noyes, of Newton, Holden, of Lowell, Learned, of Boston, Perkins, of Watertown, Grannis, of New Haven, Coffin Valve Co., of Boston, Kiernan, of Fall River, Hancock, of Springfield, Hall, of Quincy, Sprague, of Malden, George Woodman & Co., of Boston, Stacy, of Marlboro, Jenks, of Pawtucket, Kelley, of New York, Baldwin, of Boston, Welch, of New York, Tilden, of Boston, Forbes, of Brookline, Brown, of Charlestown, Chadwick Lead Works, of Boston, Kent, of Woonsocket, Wilcox, of Waltham, Harris, of Waltham, Beals, of Middleboro, Fuller, of Boston, R. D. Wood & Co., of Philadelphia, Babcock, of Nashua, and Taylor, of Worcester.

After cigars had been lighted, President Rogers called the company to order, and in a few well-chosen words expressed his pleasure at the interest shown by the large attendance and lively interchange of ideas, and then called upon several gentlemen for any remarks that might be suggested by the occasion. Alderman Pettee spoke of the importance of preserving the perfect purity of public water-supplies. Mr. Harris started a discussion upon the source from which wells or galleries near a running stream receive their supply, and detailed some experiments made at Waltham, Mass. Mr. Rotch, of Boston, gave a brief account of some experiments which he made some years ago for the Boston and Providence Railroad Company upon a well at Mansfield, Mass., to determine the company's liability to certain mill-owners who claimed that the water in the well came from their mill-stream. Observations on the temperatures of the well and river waters which Mr. Rotch had made gave the case to the railroad company.

Mr. Fuller thought that in such a case the stream was indirectly robbed, because the ground-water taken from the well might have found its way into the stream.

Mr. Noyes thought that the interception of water had been declared by the Supreme Court of Massachusetts to be cause for damage.

Mr. Babcock gave some account of an unusually abundant supply of ground-water which is obtained at Nashua, N. H.

THE GRAVE OF RANDOLPH CALDECOTT.

IT illustrates the far-reaching effects of journalism to-day that a note hastily penciled to us by an architect of this city, which we published, should be reprinted in the *Pall Mall Gazette* and so come to the eye of his widow in England. Our correspondent calling attention to the then neglected condition of the grave at St. Augustine, Fla., at the time of his visit, last April, Mrs. Caldecott wrote at once to the *Pall Mall Gazette* to say that steps had already been taken by her to provide a modest stone at the grave, while another effect of the reprinted letter was to start a subscription among the children of England and America to raise a fund for a more expensive memorial. Friends of the late artist will be glad to note the success of the movement in England, mentioned in a letter of Mr. Henry Blackburn, of this city, to the *Evening Post* of recent date, from which we quote below:

"As paragraphs have appeared in the newspapers respecting the neglected state of my friend R. Caldecott's grave in Florida, I think it right to make public a few lines from a letter from his widow, just received:

"'In the cemetery at St. Augustine,' she writes, 'I had placed what I did not consider to be necessarily permanent, but I arranged that the grave should be kept sacred to his memory until I could consult his family and friends in England. * * * Before leaving Florida I chose a plain gray marble headstone with just his name and the date of his birth and death, so that anything further might be added.'

"Mrs. Caldecott also states that she has 'just heard from a friend at St. Augustine that the cemetery, which is quite new, is now in better order,' and I have reason to believe

that Mrs. Caldecott's wishes as to the grave will soon be carried out.

"But on the general question of the most fitting memorial that should be raised to this gifted artist nothing has yet been settled in England, and it would be desirable to have some expression of opinion in this country, where his works are so widely known and appreciated. From communications I have already received there seems to be a widespread desire among the children of various countries to do something for the memory of their friend, and it may be that this letter may lead to some good suggestion from America. On this point, however, Mrs. Caldecott will first be heard.

"'I should not like,' she writes, 'any kind of charitable or philanthropic endowment, or anything specially connected with art. Everything of that kind seems to me liable to be perverted from its real use, and the name in which such things are started is generally lost sight of in the course of years. Randolph Caldecott's absorbing interest was in art, and by his illustrations he has done so much to please children and grown-up people, that I do not feel anything else to be necessary to make his memory loved. He has in his life benefited people in a way that others cannot, and his works will continue to do this for a time, at any rate; but I long to know that there will be a lasting token of the love and admiration that is felt for him—something for future generations as well as for this.'

"A memorial to R. Caldecott will be raised in England, and I shall be glad to forward any suggestions to his friends who are forming a committee for the purpose."

JOURNAL OF THE NEW ENGLAND WATER-WORKS ASSOCIATION.

Vol. I., No. I., September, 1886.

"The Journal," as published for the first time, is so interesting and instructive a pamphlet that it is to be hoped that it will be issued frequently if it is kept up to its initial standard; though since subscriptions are expected, the omission to state how often it is to be published is noticeable.

This number contains the papers read at the fifth annual meeting of the association whose name it bears, which was held at New Bedford in June, 1886, and the discussions of those papers and other subjects which came before the meeting.

In the reports of the various committees which had been appointed at previous meetings to try and collect data on specific points of practice in water-works, the one thing most prominent is the difficulty of obtaining replies to circulars asking for information. This is a difficulty which every one who has attempted to collect statistics has encountered, and an individual or a committee has to be very enthusiastic and determined not to become discouraged at the apathy and neglect of the people who know quantities of useful things but are too lazy or indifferent to spend a few minutes in imparting their information to inquirers.

There are two valuable papers in this number, one by George A. Ellis, C. E., on the discharge of water-mains as determined by the pressure-gauge; the other on the amount of rainfall available for water-supply, by Desmond Fitzgerald, C. E., and there are a number of interesting discussions by various persons on practical subjects connected with the management of works of water-supply, a branch of business which is growing more rapidly than ever before, and in which the deficiency of experienced managers is felt very seriously. There are now, or at all events will be in a few months, 1,500 water-works in operation in this country, and the manager of every one of them would be benefited by constant perusal of this journal, if its succeeding numbers fulfill the promise of the first one. The Secretary of the New England Water-Works Association, Albert S. Glover, West Newton, Mass., will receive subscriptions at $2 per year or 75 cents for a single number.

PHILADELPHIA PAVEMENTS.

Our Philadelphia correspondent writes under date of December 7: "The much-needed reform of street pavements for the city has been agitating the minds of Councils for some time, and lately a committee of that body's Highway Committee has been considering the different plans, and after investigation have agreed to recommend the trial of brick roadways like those in use in St. Louis and a few other Western cities."

TORONTO COMMISSIONER OF HEALTH AND WORKS.

The Executive Committee, after careful consideration of the qualifications of the twenty applicants, have recommended Mr. Charles Sproatt, City Engineer, for the appointment, which will doubtless be ratified by the Council.

PERSONAL.

Governor Hill has appointed ex-Senator Thomas Newbold, of Poughkeepsie, and Prof. Maurice Perkins, of Union College, Schenectady, to fill vacancies in the New York State Board of Health, caused by the resignation of Dr. Moore and the death of Erastus Brooks.

The newly-appointed Surgeon-General of the Army, Dr. Moore, of San Francisco, has arrived in Washington and entered upon his duties.

The new Croton Aqueduct Commission has appointed Mr. James W. McCulloh special assistant to the Chief Engineer, for duties connected with the functions of the Committee on Real Estate. Mr. McCulloh was for several years the Secretary of the Commission until removed last summer for political reasons.

Lieutenant-Colonel P. C. Hains, Engineer Corps, has been ordered to New York from Washington on public business. Lieutenant-Colonels W. P. Craighill and William E. Merrill, Corps of Engineers, have been ordered to Washington on business pending in the Court of Claims. Second Lieutenant John P. Finley, Signal Corps, has been ordered to Sandy Hook, N. J., to inspect certain Signal Service property.

HYATT VERSUS JOHNSON PATENT SUIT.

An important decision has recently been rendered in the United States Circuit Court for the Eastern District of Pennsylvania, by Mr. Justice Bradley, of the United States Supreme Court, sustaining important patents granted to Mr. John W. Hyatt for improvements in filters, and which are among others owned by the Newark Filtering Co.

The case was brought in Philadelphia by the Newark Filtering Co. *vs.* John E. Johnson, for infringement of patents Nos. 273,542, dated March 6, 1883, and 293,748, dated February 19, 1884, the former of which protects the method of removing impurities from filter-beds by transferring the filtering substance under water-pressure from one compartment to another in such manner that the particles of which the bed is composed are brought into frictional contact with one another and with the water, and conducting the separated impurities away with the waste water; and the latter patent protecting a filter in which is employed a current of water for assisting the transfer of filtering material from one compartment to the other.

The defendant had been engaged in the sale of filters claimed to be manufactured under patents granted to Henry Roeske, dated March 17, 1885, and December 29, 1885, and numbered respectively 314,150, and 333,481.

Mr. Justice Bradley after hearing the case rendered a decision in favor of the complainant sustaining the claims of the patent, and that the defendant having manufactured and sold filters so constructed as to allow the filtering material to be cleansed in the manner above described had infringed upon the complainant's rights. He accordingly issued a perpetual injunction restraining the defendant from making, using, or vending to others to be used, the inventions forming the subject-matter of the above-mentioned patents. George S. Harding was appointed master, to ascertain and assess the damages to the Newark Filtering Co. arising from the infringement of their patents.

The New York Master Plumbers' Association has offered a reward of $500 for the arrest of the persons who assaulted William Elliot, a journeyman plumber, who recently left the union and went to work for a master plumber of this city. A reward of $100 is also offered for the arrest of the persons who some time called at the shop of James Gilroy, and tried to intimidate one of his workmen.

CEMENT-LINED PIPE IN CHARLESTOWN DISTRICT, BOSTON.

Mr. William Jackson, City Engineer of Boston, informs us that the Boston Water Department is taking out the cement-lined water-pipes and substituting cast-iron pipes, as rapidly as circumstances will permit, in the Charlestown district, the only portion of the city in which the cement pipe has been laid. In the case of large mains iron is of sufficient thickness to be able to withstand the action of rust for a long period, but with the smaller pipes the rusting of the thin sheet-iron soon results in the destruction of the pipe.

We recently noticed the reorganization of the Polytechnic Association of the American Institute in this city. It is now proposed to have semi-monthly meetings at the hall in Astor Place, with reading of papers, exhibition of models of inventions, etc. The facilities of the library and reading-room will be increased, and the formation of an indexed collection of trade catalogues will be begun at once. The first meeting will be held December 9. Mr. D. R. Gardner, Secretary, at the hall of the Institute, will give further information.

Michigan Society of Civil Engineers will meet in Lansing next month.

The architectural students of the Massachusetts Institute of Technology, at Boston, have organized an architectural society. J. B. Gay, class of '87, is President.

The report made to the Prefect of Police of Paris, on the operations of the municipal chemical laboratory, which is charged with investigating adulterated food and drugs in the city, shows that during the month of October, 1886, 4,122 establishments were inspected and a large quantity unsound meat, fish, and vegetables destroyed. Of samples of suspected adulterations, and which would therefore yield a large percentage of actual adulterations, there were found as follows: In 537 samples of wine, 42 were found to be diseased—that is, undergoing a bitter or acid fermentation—and 89 had been plastered beyond the limit allowed by law, and 21 contained salicylic or boric acid. Of 6 specimens of vinegar, 4 were pure. Of 207 specimens of beer, 109 were pure.

New Advertisements.

Steam and Hot-Water Heating.

NOW READY! PRICE, $3.00, POSTAGE PAID

STEAM-HEATING PROBLEMS;

OR,

Questions, Answers, and Descriptions

RELATING TO

STEAM-HEATING AND STEAM-FITTING,

FROM

THE SANITARY ENGINEER.

With One Hundred and Nine Illustrations.

PREFACE.

THE SANITARY ENGINEER, while devoted to Engineering, Architecture, Construction, and Sanitation, has always made a special feature of its departments of Steam and Hot-Water Heating, in which a great variety of questions has been answered and descriptions of the work in various buildings have been given. The favor with which a recent publication from this office, entitled "Plumbing and House-Drainage Problems," has been received suggested the publication of "STEAM-HEATING PROBLEMS," which, though dealing with another branch of industry, is similar in character. It consists of a selection from the pages of THE SANITARY ENGINEER of questions and answers, besides comments on various problems met with in the designing and construction of steam-heating apparatus, and descriptions of steam-heating work in notable buildings.

It is hoped that this book will prove useful to those who design, construct, and have the charge of steam-heating apparatus.

CONTENTS:

Address, BOOK DEPARTMENT, THE SANITARY ENGINEER, 140 William Street, New York.

Obtainable at London Office, 92 and 93 Fleet Street, for 15*s*.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 3. PUBLISHED EVERY SATURDAY.

NEW YORK, DECEMBER 18, 1886.

LONDON, JANUARY 1, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 140 William Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

THE DUTIES AND POWERS OF BOARDS OF HEALTH.

IN the organization of a public sanitary authority, which is a work now going on in several parts of this country, and which for much the larger portion has yet to be done, it is evidently of great importance to begin right, as far as possible. In most cases it is true that it is not possible at first to give to a health board such powers and responsibilities as it should possess, because public opinion will not sustain such action. It is necessary to convince the people by actual experience that the board may be relied upon to deal fairly and justly with the many conflicting interests which come before it.

Theoretically, a board of health should have great power. This is well indicated in the following extract from the opinion of Judge Wells in the case of the city of Salem *vs.* Eastern Railroad Company, 98 Mass., 449: "The action of boards of health is intended to be prompt and summary. They are clothed with extraordinary powers for the protection of the community from noxious influences affecting life and health, and it is important that their proceedings should be embarrassed and delayed as little as possible by the necessary observance of formalities. * * * Delay for the purpose of giving notice, involving the necessity either of public notice or of inquiry to ascertain who are the parties whose interests will be affected, and further delay for such hearings as the parties may think necessary for the protection of their interests, might defeat all beneficial results from an attempt to exercise the powers conferred upon boards of health."

Practically, such powers as those indicated by Judge Wells can be given to a board of health only in a community which has been educated as to their utility, and in which individuals and corporations, knowing the direction and extent of the probable enforcement of regulations for the prevention of nuisance and the protection of the public health, make their arrangements accordingly.

We have been led to these and similar reflections on examining the "Manual for the use of Boards of Health of Massachusetts," recently published by the State Board of Health, in a volume of 117 pages. This manual contains the statutes relating to the public health and the decisions of the Supreme Court of Massachusetts relating to the same, which last are now sufficiently numerous and cover enough points to form a very valuable addition to the work. While it does not contain all the legal provisos which are desirable, it is, nevertheless, a most instructive collection of the results of legislation based on long experience in one of our most densely populated States, and as such should be studied by all who are interested in sanitary jurisprudence.

NO GRADE-CROSSINGS IN CITIES.

THE recent killing of a well-known merchant by a dummy freight-train on the N. Y. C. R. R. on the west side of this city has again called attention to the necessity of compelling our wealthy railroad corporations, whose railroads traverse the streets of our populous cities, to either elevate or depress their tracks when going through the crowded portions of the cities. We are therefore glad to see the New York *Times* in a recent issue, in alluding to the offer of the Pennsylvania Railroad Company to elevate its tracks in Jersey City above the grade of the streets, encouraging the citizens of Connecticut to insist that the N. Y., N. H. & Hartford Railroad Company shall have no grade-crossings on the streets of cities of that State. We quite agree with the *Times* when it says: "A company whose net earnings are 17 per cent. of its capital, and whose annual dividends are 10 per cent., should be willing to pay the expense of elevating or depressing its tracks in the heart of a city where important streets are crossed at grade."

In the sparsely-settled portions of our country, when the demand for railroad facilities was imperative, it was impolitic and impracticable to demand such expensive construction. That is not the case, however, with the wealthy corporations in the older-settled portions of this country. There is no reason why they should be exempt from the requirements that obtain in Great Britain in this respect, since, in some portions of our Eastern States at least, the conditions are now quite similar.

MAYOR GRACE, of New York, did a sensible act in vetoing a resolution passed by the Board of Aldermen, which required that the pressure of steam in the street-mains of the Steam Company should never exceed fifty pounds to the square inch. A year or two ago an attempt was made to create a scare over this matter, on the ground of the fertilization of germs by the warmth from the pipes, but it failed. There are objections to the tearing up of the streets and creating a nuisance by the obstruction of traffic, and a wasteful destruction of pavements, such as has been witnessed for several years in our down-down streets. But the germ cry is an empty bugbear, and Mayor Grace rightly vetoed the resolution. His reasons are worthy of quotation:

> "The pressure now used by the Steam Company is about eighty-five pounds to the square inch. I have been informed by competent scientific authority that the danger from leakage would be to some extent lessened by your resolution, but would be by no means entirely avoided. I have, however, been informed by the same authority that the difference between fifty and eighty pounds in the pressure would in no way affect the danger from explosion, and that the danger of the liability of malarial poisoning, if it exists at all, which is doubtful, would not be lessened by the reduction of the pressure proposed. On the other hand, if the resolution should become operative it would result in serious inconvenience to many consumers who use it to run their engines, and who have dispensed with their boilers, in consequence of this reduction. It would also seriously affect the capacity of the company in supplying customers who use the steam for other purposes."

CHOLERA IN GERMANY.

A SMALL localized outbreak of Asiatic cholera has occurred in the villages of Gonsenheim and Finthen, lying an hour's journey west of Mainz-on-the-Rhine. In Gonsenheim, a village of 3,000 inhabitants, the first case occurred on September 6, and the last on October 13, there being in all nine cases and five deaths. In Finthen, which has about 2,000 inhabitants, there were thirteen cases with eight deaths, the first case reported occurring September 25 and the last October 24. The symptoms were characteristic, and Koch's cholera bacillus was found in one of the cases. How the disease was introduced is unknown, there being many conflicting rumors.

Cholera also exists at several points in Hungary, and one undoubted case from Northern Hungary has died at Breslau. These are facts of the gravest significance for this country. During the last three years we have from time to time commented on the progress of cholera in Southern Europe, and have predicted that it was not likely to soon reach the United States, on the ground that one great source of danger is through our immigrants and their baggage, and that until cholera effected a foothold in the centres of population from which emigration takes place to this country we might reasonably hope to escape.

Now, however, the disease seems to be on the verge of appearing in those centres, if it be not already there, and we much fear that next spring the disease will manifest itself unmistakably in Northern and Central Germany. Now therefore is the time for preventive action on the part of all concerned. Special precautions should be taken with regard to emigrants from the suspected region. States should provide funds for an emergency, and strengthen the hands of their sanitary authorities, especially in the line of systematic inspection and the looking after public water-supplies, and local authorities should see to it that the best possible conditions of surface and soil cleanliness are obtained, and that polluted wells are done away with.

OUR BRITISH CORRESPONDENCE.

A Fire-Proof Cement—A Test Case under the Building Act of 1882—New Submarine Torpedo Boat—Southampton Sewage Disposal Works.

LONDON, December 1, 1886.

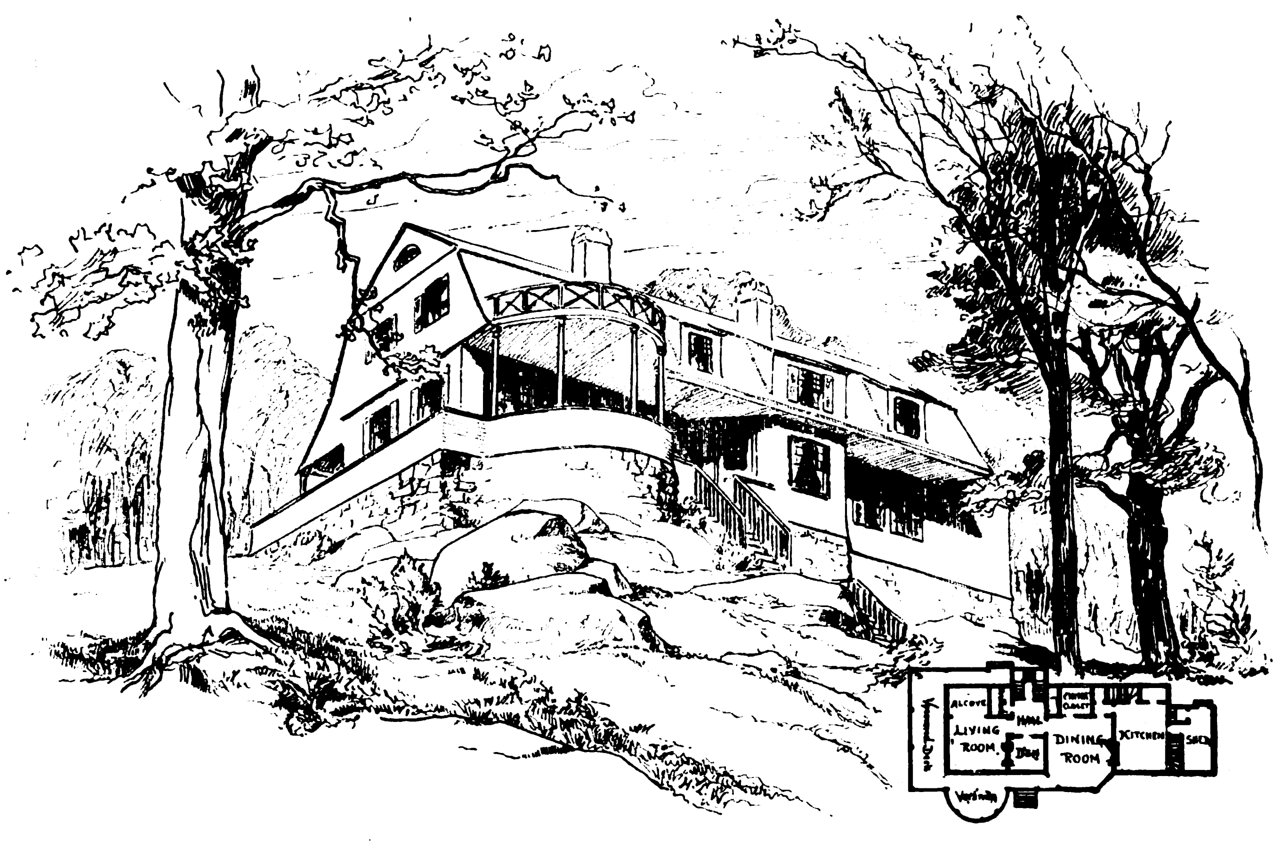
A FIRE-PROOF cement, made at the Knox Hill Plaster Works, Carlisle, has just been patented. Its base is sulphate of lime, and it is claimed that it can resist very intense heat, while, at the same time, it is not susceptible to the effects of extremes of temperatures.

An important decision bearing upon the Building Act of 1882 has just been given at one of the police courts. Section 14 of the act provides that in the case of every new building there shall be open space behind, exclusively belonging thereto, in the proportion of about 10 feet to 1 foot of frontage. A builder in Chelsea recently tried to sail round the regulation, contesting the application of the surveyor for an "order," on the ground that the building in question, situated in a mews, was for "stables, with coachman's rooms over." The magistrate decided that the act was applicable.

A new submarine boat destined for torpedo warfare has just been tested in the West India Docks. Fletchers, of Limehouse, are the builders. The boat is cylindrical, with tapered ends, 60x8-feet beam, $\frac{5}{16}$-inch steel plates on a steel frame. The apparatus governing the power of flotation are (1) water-tanks and (2) a series of eight cylinders, four on each side, projected to a distance of two feet on each side, and withdrawn at will. The gearing to wind out these projectors is in the hull, and worked by the crew. The projectors are water-tight drums, and their additional displacement when wound out provides the extra buoyancy necessary to float the vessel. The propellors are twin screws driven by electricity, the storage batteries providing power for a working speed of 36 horse-power for six hours (speed ten knots). When the vessel is submerged fresh air is supplied from reservoirs of compressed air passed over caustic potash, and replacing automatically the consumed air. There are secondary means of raising the vessel in case of accident to the projectors by a parallel fish-tail rudder and false keel, which latter is detachable.

New works in connection with the sewage disposal of Southampton have recently been opened. Great difficulty has hitherto been experienced by the "ponding" back of the sewage in the outfall sewers for several hours every day, owing to the meeting of opposing currents from the Atlantic and German Oceans. Two settling-tanks have now been provided, for alternate use, in which the sewage is received. Previous to its entry into the tank the sewage receives the precipitating medium—*i. e.*, porous carbon, the proportion being three grains to the gallon of sewage. The carbon is fluxed with water and is thoroughly mixed with the sewage in the course of its delivery into the tank. When one tank is full the second one is taken into work, while precipitation is going on in the first. When the solids have settled, the effluent, which is tolerably clear and perfectly devoid of smell, is run off, and the sludge passed into a Shone's hydro-pneumatic ejector, by which it is lifted to another tank, where it is thoroughly mixed with road-sweepings. There is considerable demand for this mixture by neighboring farmers, at 2*s.* 6*d.* (60 cents) per ton as manure, orders being booked in advance. The sewage dealt with is that of some 13,000 inhabitants.

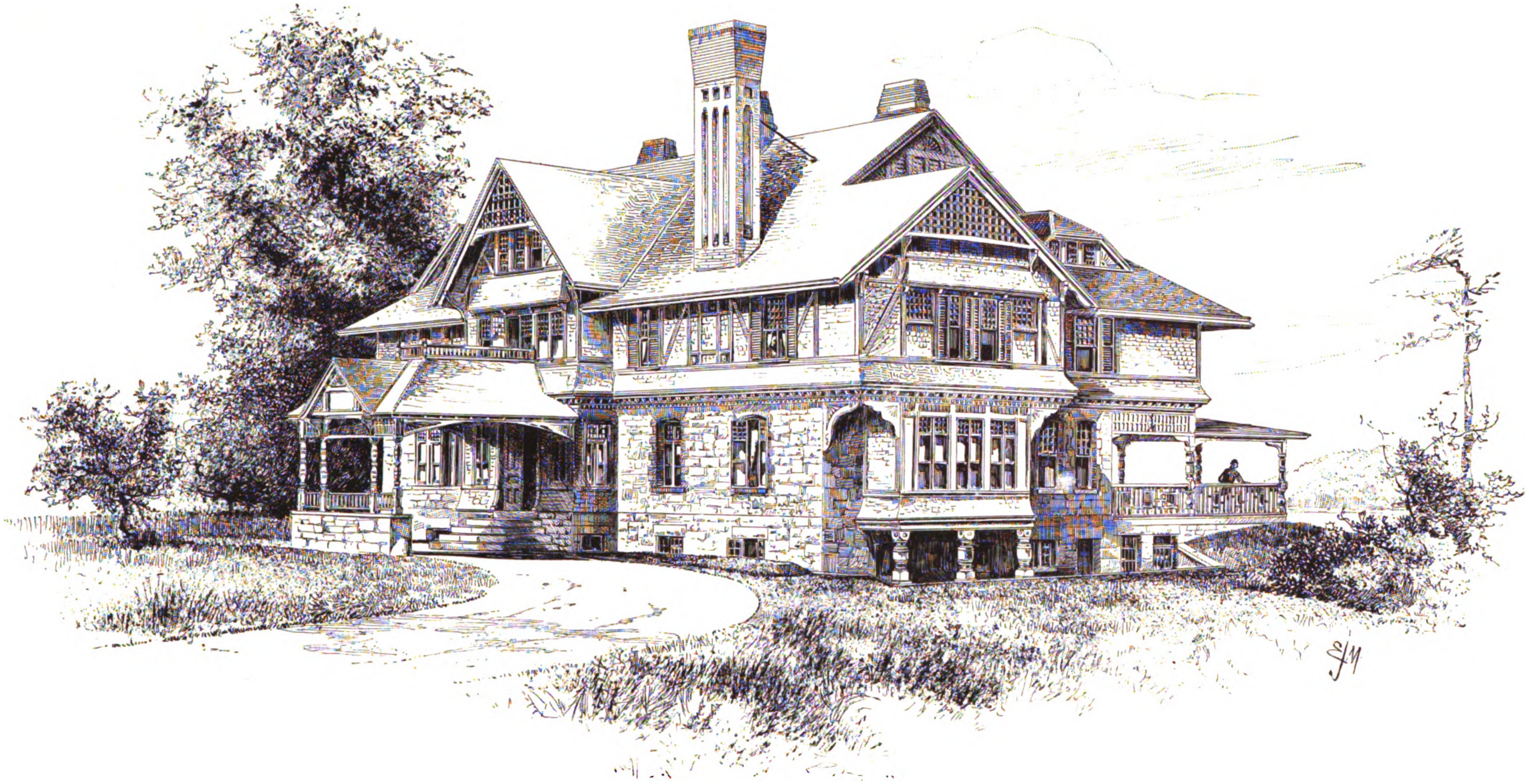
SAFETY-VALVE.



A SUMMER COTTAGE AT MANCHESTER, MASS.—ANDREWS & JAQUES, ARCHITECTS.

A CORRECTION.

ON page iii. of our "Contracting Intelligence Supplement," December 4, appeared a very absurd paragraph which our news editor credited to its source, the New York *World*, and allowed admission without notice to our columns. It was to the effect that the Keystone Bridge Company of Pittsburg had been awarded a contract for three miles of double track elevated railroad in Jersey City, to cost two million dollars, and to consist of 120 spans of plate girders weighing 750,000 pounds. If an elevated railroad were built in spans of 132 feet, it is likely that each span of double-track would contain more than 6,250 pounds of iron, unless the road were built on some new "system" as yet undivulged. The iron would have to be somewhat elaborately manipulated to be worth $2.66 per pound at any rate. The fact of the matter is, that some enterprising reporter got the rumors about the Pennsylvania Railroad's intentions to raise the tracks in Jersey City mixed up in his mind with the contract made by the New Jersey Railway Construction Company last summer to build a mile of the Suburban Rapid Transit Road in the upper part of New York City across the Harlem River, and for which the Keystone Bridge Company is furnishing ten times the amount of iron reported, and for less than one-sixth of the sum named, and have their work well advanced.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES

RESIDENCE OF MRS. MARY W. STRANG, NARRAGANSETT PIER, R. I.

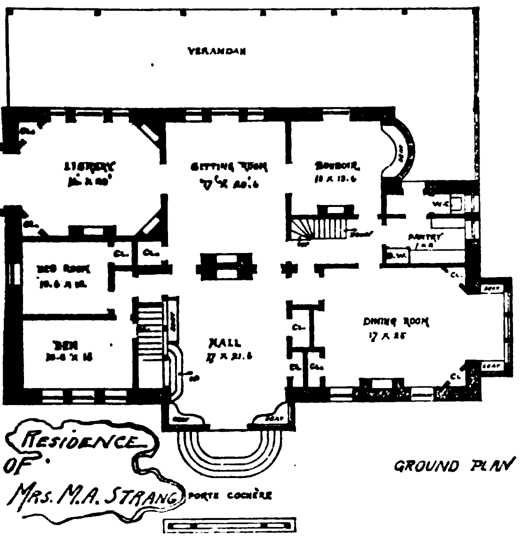
DOUGLAS SMYTH, ARCHITECT.

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

RESIDENCE AT WAKEFIELD, NEAR NARRAGANSETT PIER.—DOUGLAS SMYTH, ARCHITECT, NEW YORK.

OUR special illustration this week shows the residence of Mrs. Mary W. Strang, at Wakefield, near Narragansett Pier. Rough granite is used in the construction of the first story, and the upper stories are shingled. Ash and oak constitute the interior finishings, with fire-places of



brick and terra-cotta. The floors are of hard wood. There is a large main hall, two stories high, encircled by a balcony opening into all bedrooms, and the large rooms on the lower floor are so arranged as to have a view across a lake, with distant sea view. The building is surrounded by a veranda 14 feet wide. The cost was about $20,000. Mr. Douglas Smyth, of New York, was the architect.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A SUMMER COTTAGE AT MANCHESTER, MASS.—ANDREWS & JAQUES, ARCHITECTS.

THIS house is built high on the rocks overlooking the sea in a clearing in the woods. It is the summer residence of Dr. Walter Channing. It is a frame house, covered with stained shingles, and has painted trimmings. The cost of the house was about $5,750. The architects are Messrs. Andrews & Jaques, of Boston, Mass.

COTTAGE (SMALL) HOSPITAL CONSTRUCTION.

BY HENRY C. BURDETT.

Author of Cottage Hospitals, Pay Hospitals of the World, etc.

No. XI.*

SURBITON COTTAGE HOSPITAL.

THE predecessor of the present building was a cottage pure and simple, hired and fitted up as a hospital, and which proved so useful that its promoters determined to build a permanent hospital.

The site is an oblong strip of ground, about 450 feet wide and 225 feet long—just such a plot of ground as one would build a moderate-sized villa upon. The building is of two stories, with a small basement containing coal and wine cellar and stores.

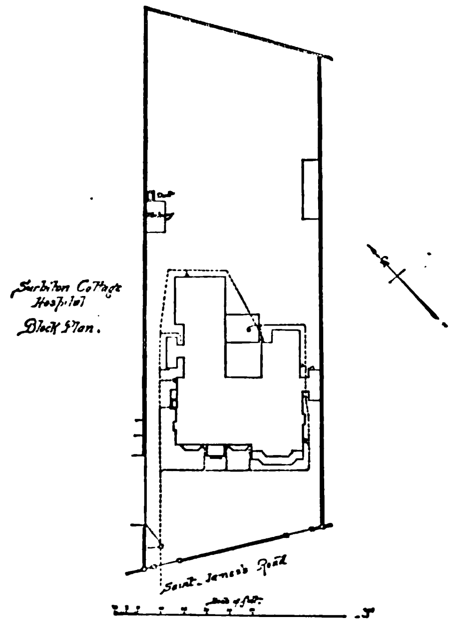
The ground floor contains all the administrative offices, and also a single-bed ward for accidents, with nurses' room attached, and a large day-room for convalescents.

To right and left of the front entrance are the matron's sitting-room and the committee-room. Attached to the former are large stores, and to the latter is a drug-store.

The day-room for convalescents is a spacious apartment, 20x25 feet, with a large bay window and veranda facing south-west.

At the side of the accident ward is an entrance-door specially arranged for access to this ward without passing through the building. Close to this ward is the operating-room, 15x14 feet, lighted by a large skylight and also by a window to the north-east.

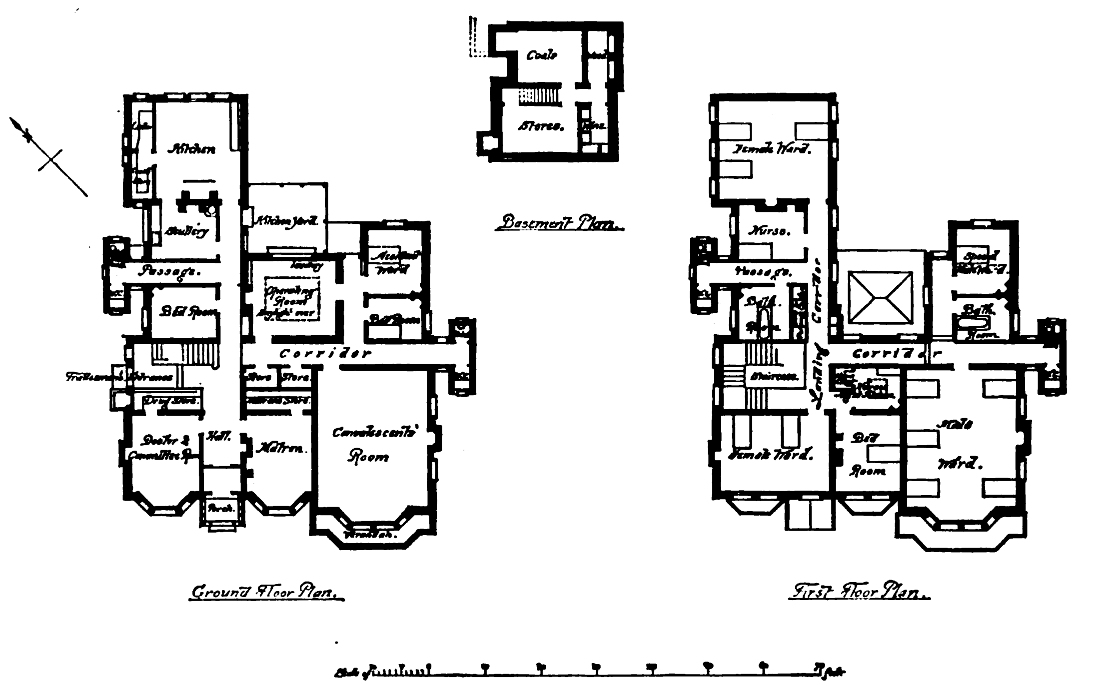
The kitchen offices are placed at the back, and well



isolated by means of a lobby with swing-doors from the rest of the ground floor.

On the first-floor are the wards, four in number—one

SURBITON COTTAGE HOSPITAL.



for males, with five beds; two for females, for two and three beds respectively; and one single-bed ward for special cases. The floor-space per bed is about 100 feet, and the cubic space 1,200 feet. Attached to each ward is a nurses' room, that between the male and female wards having no less than three windows looking into the wards. As a matter of fact, these inspection-windows are of very little service, being seldom or never used, and as often as not being entirely obscured either with books or curtains.

Adjoining the male ward is a room called "nurses' night kitchen," the *raison d etre* of which it is not very easy to see. It would have been better to have arranged a small ward-scullery next to each ward, and to have provided a separate dormitory for the nurses. As it is, it is not very plain where the night-nurse is to sleep. If the bedroom on the ground-floor is for her use, it is about as badly placed as can be, and it would be equally undesirable to place her in either of the bedrooms adjoining the wards.

In the passages leading to the male ward and to the special ward are two steps up and two other steps down. Nothing in the plans suggests the reason for this arrangement, which, in the absence of the most urgent necessity, ought most certainly not to have been allowed.

The few defects we have mentioned do not very seriously mar an otherwise excellent plan. Specially to be commended are the water-closet arrangements. These conveniences are all placed in wings separated from the main building by cross-ventilated lobbies. The bath-rooms are fitted with glazed porcelain baths. A lift ascends from the coal-cellar to the first floor, and between the latter floor and just outside the kitchen-door is a speaking-tube.

The wards and day-room are warmed by Boyd's ventilating-grates, which afford a constant current of warmed fresh air.

The drains appear to have been carefully laid; sink and bath-wastes discharge over open-trapped-gullies; the soil-pipes are carried up full bore to the roof; and the drain is trapped off from the sewer by a "Kenon" trap. An additional manhole or two for access to the drains would have been an advantage, but the system of drainage as a whole is so eminently superior to what is, unfortunately, so commonly met with, that one is not inclined to be hyper-critical.

The cost of this hospital is put down as "about £3,000." The plans were prepared and the erection of the hospital superintended by Mr. Ernest Carritt, architect.

* No. X., the Cottage Hospital at St. Paul's Cray, Kent, was illustrated in our issue of November 20, 1886.

FOUNDATIONS ON UNSTABLE SOIL.*

MR. BOYINGTON premised by stating that what he would say would refer entirely, though he hoped without immodesty, to his own experience, as he was of the opinion that for an association like this something practical, something that has been done, something that is a little out of the ordinary course was fully as interesting and beneficial as theories which have the name only of being practical. His address would be largely on foundations. No one could be a thorough architect who did not have a thorough knowledge of foundations. A bad foundation would result in an unsightly and perhaps an unsafe structure. The question of the weight that a soil would sustain was a peculiarly important and difficult one in Chicago. Some would say that piling was the only safe foundation for a compressible soil such as we have in Chicago and elsewhere. Others would say that concrete is the only proper thing. Others recommended timber. He had found it desirable to use all these kinds, adopting them as circumstances seemed to demand, and sometimes combining all three for one structure. He had had success using each separate and all combined. Cast and wrought iron and steel rails have been used for the purpose of covering large areas, thus saving the work of going down deep enough to secure proper offsets for masonry, and avoiding having the masonry occupy so much surface in the basement. The cost of applying steel is not so great as of a larger amount of solid masonry. A writer had recently questioned whether steel rails for this purpose were entirely safe, owing to the action of cement upon them, and accordingly preferred cast iron. He was brought up among engineers, master builders, and architects. Architects in those days were few. Master builders were something more than contractors. Formerly they would vie with each other to see who could do the best work, but lately they vied with each other to see who could scant their work the

* Abstract of a paper read by W. W. Boyington, of Chicago, at the meeting of the Western Association of Architects in Chicago, November 18.

best—with some honorable exceptions. He had often adopted puddling in preparing foundations, old buildings thus treated standing well to-day. The frequent digging up of Chicago streets was referred to; if the city would require that the holes should be puddled with gravel, a true level would be restored. The timber construction in the Marshall Field warehouse was what the speaker had used forty years ago in building the Holyoke, Mass., cotton mill, the largest cotton mill ever built in this country. In rebuilding the Chicago water-works, he had found it necessary to place the chimney directly over the old wooden water-conduit. He drove the piles around the latter and covered them with oak timbers and filled the space between the timbers with concrete, not putting any on the conduit, and then laid planks and the stone foundation. All stood well for nearly two years, without a settlement, and then came an illustration of how closely a collapse can be escaped. When the new tunnels connecting with the pumping-wells were put in the engineer took his own course without my knowledge of what was being done below the foundation of the chimney. Mr. Cregier, the City Engineer, sent for me one day to come over to the water-works, as there was trouble with the chimney. Going over I found to my surprise that the chimney had gone down about five or six inches, all at once, though still standing plumb on all sides. I inquired what was being done below. Nothing, that he was aware of, that should interfere with the chimney. Mr. Chesbrough then said the engineer was putting in a new tunnel. I asked if he could give the location and depth by the plans in his office, and he showed me that the tunnel was directly under the chimney and so many feet below the surface. I took the data and found that the top of the new brick tunnel was about two feet below the bottom of my piles. [Laughter.] The men in the tunnel discovered that the earth was giving in all at once when they were just half way under; then it as suddenly stopped and didn't go any further. Nothing has happened since, though, of course, a strong arch was put in, and I believe the whole work is in good condition. An iron stand-pipe, 120 feet high, for the water-works had to be built over quicksand twenty feet below the surface, and it was difficult to manage, so we drove piles very closely together. Each drove very hard for the last two feet, having struck hard pan—that is, as near hard pan as we find in this country. [Laughter.] It was a gravel clay and answered a very good purpose. On the piles came heavy timber filled with concrete, and then a 3-inch oak plank, with heavy stone foundations on top. The walls surrounding the stand-pipe with the iron stairway rest on the same foundation, the walls being pierced with five large holes for the receiving and discharging water-mains. The inclosing building is put on piles entirely independent of the other piles.

Another interesting experience of the speaker was in putting in the foundations for the tower of Chicago University and for the neighboring Dearborn Astronomical Observatory in this city. The former is 160 feet high and rests on sandy gravel several feet in depth, and rises from the surface without any digging down for foundations. Only 100 feet west there was no gravel for the astronomical tower, on which the telescope was to rest very firmly, but instead a mass of quicksand was found. We went down twenty-five feet in this quicksand, and drove long piles below that. We capped the piles with timbers and concrete between them, and then put heavy planks on that, and then the stone foundations commenced. Again, the inclosing building was built on piles higher up and entirely independent, so that the tripod of the astronomical tower does not touch in any point the four floors of the building, it being feared that any movement on them might jar the tripod. A perfect success was secured without the least settlement or deviation from the perpendicular. The other tower, with quicksand far below and twelve feet of gravel on top, stands just as true. Where two owners could not agree, as regarded a party-wall, difficulties resulted often, and the speaker's experience varied. I have built walls on one side of a party-line on some of the highest buildings in the city, although I was told by architects that it could not be safely done. It is a well-established law in mechanics and engineering that where a known force is exerted in one direction causing an inclination, such inclination can be successfully resisted by applying mechanical force in an opposite direction. I am willing to stake my reputation as an architect on the possibility of doing this in the line of work referred to. Yet some sad mistakes are made and have been made even by highly educated young architects, who were not educated in experience, though such have afterward become highly successful. Great mistakes of the kind have happened in Eastern cities and may here in the West.

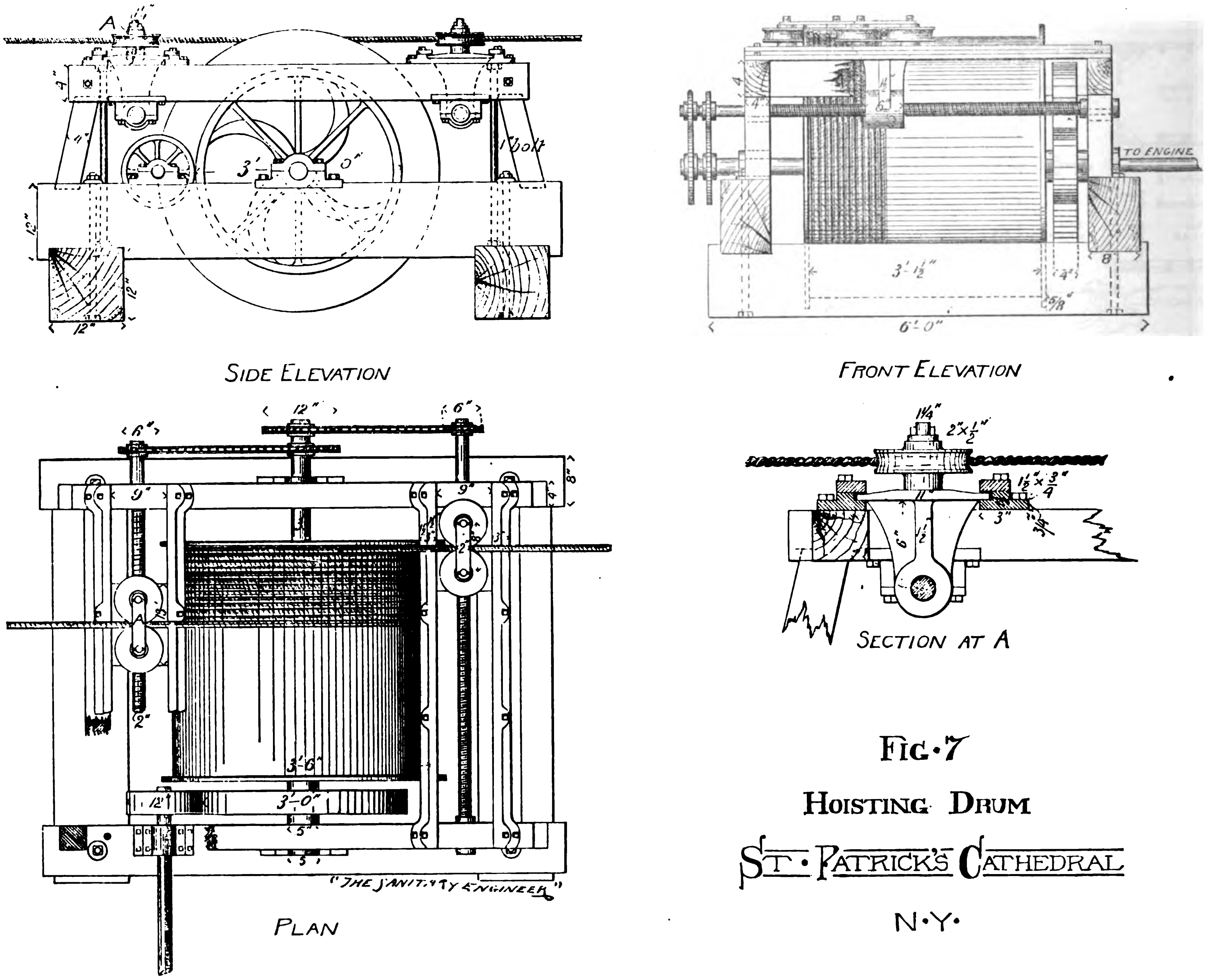
BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. IV.

(Continued from page 40.)

ERECTION OF THE TOWERS OF ST. PATRICK'S CATHEDRAL, NEW YORK CITY.

THE new drum and attachments for hoisting at the Cathedral have been designed and built by Mr. Chris. Abele, of 253 West Twenty-seventh Street, New York, and are shown fully in Fig. 7. The power is taken from



FIG·7
HOISTING DRUM
ST·PATRICK'S CATHEDRAL
N·Y·

the engine by a 12-inch pinion, with 4-inch face, gearing into a 3-foot spur-wheel. Keyed on the same shaft are two cast wheels, with 6x6x⅝-inch angle-iron rims, for the support of the wooden drum, 3 feet 6 inches diameter and 3 feet long. The wooden strips forming the drum are 3x3-inch, fastened at each end by ½-inch countersunk bolts with nuts inside. On each end of the top of the frame, and horizontally 4 feet apart between centres, are two pairs of grooved bars, each supporting a horizontal slide. These slides each carry a pair of cast sheaves, 8 inches diameter, placed horizontally, and the two branches of the rope pass to and from the drum between these. Cast to the bottom of the slides are vertical standards of cruciform section, expanding below into nuts, 5 inches diameter and 6 inches long, which traverse spindles of the full length of the drum, which are threaded throughout.

The threads are square, and there are two to the inch, and as each turn of the rope will occupy one inch length of the drum, the screw-spindle must make two turns for one

of the drum. This is accomplished by sprocket-wheels and chains of proper proportions on extensions of the drum and spindle axles, as shown. The drawing shows twelve turns of rope on the drum, but four or even less would be entirely sufficient to prevent slipping and would be better. From the arrangement of parts it will be seen that the number remains constant, unwinding from one side and winding on the other. The fewer the turns, of course, the greater the length of hoist that can be taken.

This arrangement allows the lead to be taken sharply off at an angle without the need of distance to insure a fair winding on the drum. In such a case, however, due regard must be had for the strains thrown into the framing of the machine to see that all parts are strong enough to resist them. Placing a pinion on the free end of a shaft, as in this case, is to be deprecated where heavy loads are to be lifted. Not only does it strain the shaft more, but it brings a heavy lifting force (when the load is in the right direction) on the bolting at the nearest corner.

When the work reaches the point where the highest scaffolding and derricks are erected we shall illustrate them as adopted. The scaffolding will be supported on sills passed through the openings in the tower, the uprights being thoroughly braced and tied; and a derrick similar to the one last described, possibly the same, but placed external to the tower.

The contract is being executed by Messrs. George Munn & Co., of Baltimore, and we are indebted to their representative here, Mr. Peter Hamilton, for the information given.

(To be continued.)

DISPOSAL OF SEWAGE AT THE MASSACHUSETTS REFORMATORY.*

The disposal, by improved methods, of the sewage of the State Prison at Concord, Mass., was provided for by the General Court of 1883, by the passage of a special act.

Prior to the passage of this act, the sewage from the State Prison and adjoining State property at Concord, was disposed of by a variety of methods, or rather a combina-

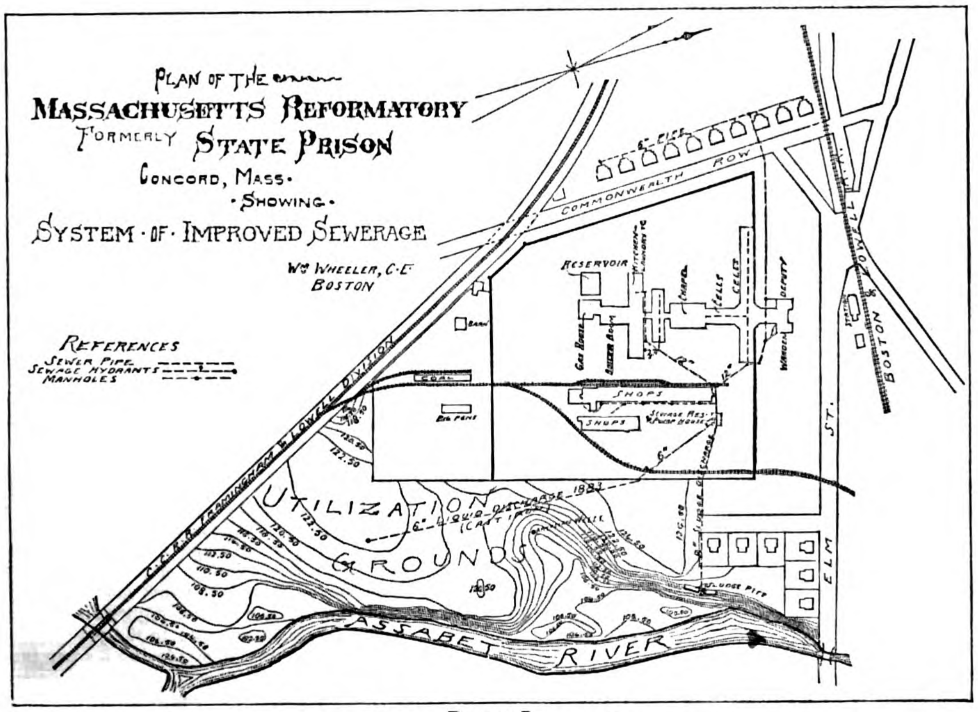


Plate I.

tion of expedients, conspicuously lacking in method as well as in simplicity of management, and in the requirements of modern sanitation, as will appear from the following outline of the drainage works as they then were:

The sewage from the main group of prison buildings and the brick workshops—amounting to upwards of 100,000 gallons per day—together with the roof-water from the same buildings, was originally carried by the lateral drains into large unventilated brick sewers, through which it was discharged in its crude state into the Assabet River, at a point about two hundred and fifty feet above the Elm Street Bridge.

The main sewer, into which emptied all the drains of the main prison, and the warden's and deputy warden's houses, was laid at a considerable declivity from the east wing to the point of discharge into the river, below the level of low-water surface. Another brick sewer, leading from the east end of the "strong rooms," and receiving the entire drainage of the gas-works, laundry, kitchen, and brick shops, entered the main sewer at a point about one hundred and sixty feet from the east wing.

Subsequently a large subterranean screen-pit, fitted with coarse wire screens, had been constructed near the line of the main sewer, just below the junction of the one leading

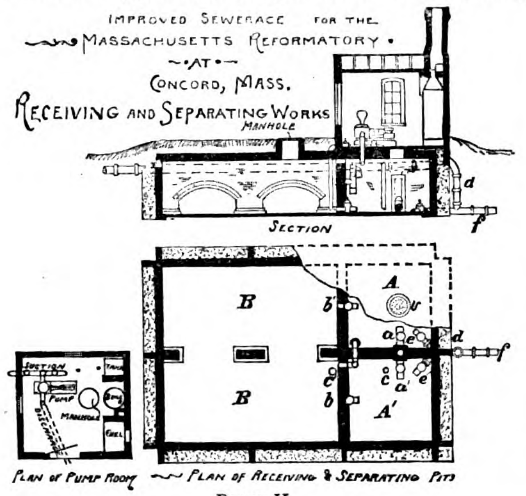


Plate II.

from the "strong rooms," and connections made through which the whole of the crude sewage could be turned into the screen-pit, where the solid portions would be retained by the screens, and the liquid portion be then returned into the main sewer. It was the apparent purpose of this contrivance to exclude from the river such floating and suspended sewage matter as had previously begun to gather along its banks and in foul deposits upon its shoal bottom, to the growing alarm and inconvenience of those who lived near, or frequented the stream below the point of discharge.

The liquid portion of the sewage, with all its soluble constituents and much of the finer suspended matter—containing, indeed, the greater part of the noxious ingredients thereof—was discharged, as before, into the river, in undiminished volume; while the inconvenience of removing the solid portion through the small manholes of the screen-pit, producing temporarily a positive nuisance, and the necessity of providing a freer course for the sewage in time of storm, subjected the operators of the works to two phases of temptation, which were apparently irresistible. These were: *first*, the opening of the gates of the main sewer, so that the whole sewage would pass around the screen-pit directly into the stream; and, *second*, the greater evil of raising the screen, and allowing the accumulations of weeks or even months of putrescent solids, or sludge, to be flushed out of the screen-pit *en masse* into the river, by the storm-flow, thus worse than undoing the work which the screen-pits were designed to accomplish.

Within the prison, each cell is provided with a water-closet and set bowl, and a group of four cells upon each of five floors, comprising a total of twenty cells, is served by a single soil-pipe. Such an abundance of sewer-connections within living-rooms of so narrow compass could be safely tolerated only with the assurance of the most perfect plumbing, and a rational and positive system of ventilation. Primarily, the second of these conditions can hardly be said to have been provided, inasmuch as each soil-pipe originally opened up into the partially ventilated attic or garret over the cells where all the ordinary ventilation pipes of the cells also opened—soil and ventilation-pipes being carried up together within the cell walls, and their open tops terminating at the same level. This defect had been corrected in the three wings of the main prison, by extending the soil-pipes through the roof after uniting four or six of them in one large pipe. In the "strong rooms," however, no change in the original plan of ventilation had been made.

The waste water from the gas-works, originally discharged into the common drains, had been afterwards excluded therefrom, and allowed to run into an open sink-hole in the free dry gravel in the rear of the buildings—its pungent odor seeming to defy the attempts made to confine it within sewer limits, and making its escape through the conductors in the vicinity of the kitchen and "strong rooms."

A portion of the roof conductors had also been disconnected from the drains in order to cut off ways by which sewer-gases might escape near the upper windows of the main prison, particularly around the hospital. The extension of the soil-pipes of the cells through the roof, as above described, seemed to have aided in obviating this danger.

The drainage from the sinks and water-closets of the isolated wooden shop, formerly used in the manufacture of picture molding (but since removed), had found its only outlet in an unsightly and unsavory sink-hole, some seventy feet back of the shop, into which it flowed through an open ditch.

A large quantity of liquid refuse, distinct from any above described, flowed from the dyeing and washing vats used in the hat shops. The amount of this was from 40,000 to 70,000 gallons per day, and, as its impurities comprised only felting fibre and dye-stuffs—harmless from a sanitary point of view—it had been allowed to flow out upon the surface of the ground and into pits from which mortar-sand and gravel had been taken, and left to soak away as best it might. Unsightly to look upon, covering, as it did, half an acre of ground at times, and destroying whatever grass or other vegetation it came in contact with, it was desirable to devise a more acceptable means of disposing of this matter also.

Finally, the sink drainage from the ten double tenements upon Commonwealth Row, so-called, occupied by officers and their families, was collected by a pipe sewer, which discharged into a large brick cesspool. This sewer was constructed at so flat a grade that the scanty flow from the sink drains alone was insufficient to keep it clear, and frequent recourse to other means, such as drawing a follower or plunger through it, had to be resorted to. The cesspool itself, although situated at sufficient elevation to render its discharge by means of a flushing syphon practicable, was not constructed with that end in view, and consequently its contents had to be removed entirely by pumping at intervals of a week or less, through the manhole, by manual labor. This involved the labor of about six men, half a day each week, or a total expenditure of six months' labor for one man throughout the year. All fæcal matter was disposed of through common isolated privies, one being provided for each tenement, water-closets not having been introduced into the tenements at that time.

Such were the somewhat heterogeneous provisions for drainage which had obtained, through frequent changes and modifications, up to the passage of the act of May, 1883—insanitary in conception, ineffectual in operation, in scope limited, in plan and method various, expensive in maintenance under their proper working, and wasteful of fertilizing constituents, in the midst of State lands combining both the need and opportunity for their utilization thereon.

Having received instructions from the Prison Commissioners, in the following June, to prepare a comprehensive plan for an improved system of sewerage, to be built under the provisions of the act of 1883, examinations and

*From the report by William Wheeler, C. E., in the Seventh Annual Report of the State Board of Health, Lunacy and Charity of Massachusetts.

surveys were first made to determine the general conditions of the problem—especially the nature and quantity of the various kinds of refuse to be disposed of, the dimensions and grades of the old drains as affecting their adaptability to a new system, the topography of the adjacent land of the Commonwealth, and the nature of its soil, as affording opportunity for the distribution and utilization of sewage thereon, and the liability of such use of the land to impair the driven wells from which the prison then obtained a large part of its water-supply.

On the 16th of August following, a plan of the projected works was submitted to the commissioners, and, after acceptance by them, was referred to the State Board of Health, Lunacy and Charity, by whom, after some changes in the selection of the lands upon which the sewage was to be disposed of, it was duly approved, September 1, 1883.

The construction of the works was begun upon the eighteenth day of the same month, and exclusive of the connection of the warden's, deputy-warden's and officers' houses, and a few minor details, was completed early in the following summer—work having been suspended during the intervening winter and spring by reason of the unfitness of the season and the inadequacy of the original appropriation.

All of the common labor, and much of the skilled work, was done by convicts, who were employed at wages agreed upon with the warden.

Plate I of the accompanying plans, compassing the entire group of prison buildings and officers' tenements, shows the general arrangement of the new system of drains and the works for receiving and disposal of the sewage.

Plate II represents, upon a somewhat diminutive scale, the principal features of the receiving and separating works, or pumping station.

The plan of the new works, while leaving substantially unchanged the general arrangement of plumbing and interior drains, involved the construction of an entirely new system of pipe-sewers outside the prison buildings, from which storm water is excluded except at a few points for flushing purposes, as later described, and whereby all the ordinary sewage is carried to a series of underground receiving and separating tanks or chambers. These chambers are separated by brick partitions sixteen inches thick, laid in hydraulic cement mortar, the outside walls consisting of an eight-inch brick lining or interior facing, with an impervious backing of hydraulic cement concrete or beton, constructed *in situ*, after the brick was laid. Every alternate brick in alternate courses is a header, projecting outward half its length, thus affording a perfect bond between the brick face and concrete backing. The whole is built upon a concrete foundation extending over the entire area of the chambers, affording a tight floor three inches thick for the tanks, and footings six inches thick under all walls and partitions, and is covered by two arches whose adjacent skew-backs rest upon a middle partition and piers, thus forming a valley which affords a passage for the main collecting sewer and safety-overflow pipes.

The chambers are provided with sewage inlets, sludge outlets, and suction pipes for discharging the liquid portion, all in duplicate, and each one in a separate compartment from and capable of being used interchangeably with its companion. Access to each compartment is had through manholes of ample size.

The sewage is commonly first admitted through an inlet valve, *a*, into a compartment, A (see "Plan of Receiving and Separating Pits," Plate II), about twelve feet square, from which, when filled to a depth of five feet, the liquid portion overflows automatically from its middle depth, through an unsealed three-legged syphon, *m*, into another chamber of the same size, A'. The second compartment, A', has connection through a valve, *b*, with a storage chamber about twenty five feet square, BB, into which the liquid portion flows in the usual operation of the works, the said liquid portion being pumped out daily through either or both of the suction pipes, *c* and *c'*, as circumstances may require.

The second chamber, A', is practically a duplicate of the first one, A, and may be used interchangeably, with either the first one as the primary receiving and separating compartment (in which case the crude sewage is admitted through an alternate inlet valve, *a'*), or with the larger one, BB, as a storage chamber and pump-well; or, as ordinarily used, in open connection therewith, it affords simply an addition to the storage capacity of the works.

With this interchangeability of uses, effected by simple devices, the function of each compartment may be performed by one of the other two, whereby each may in turn be left in temporary disuse, thus facilitating the work of discharging the sludge, and the examination, repair, and general care of the works.

By causing the liquid overflow from the receiving chamber to take place from the middle of its depth, the solid matter, which either floats or sinks, remains in the chamber, where it is allowed to accumulate until it approaches the level of the inlet of the overflow pipe or syphon. The sludge is then discharged by gravity through the valve *e* or *e'*, as the case may be, and an eight-inch Akron pipe, *f*, into a composting pit situated about six hundred feet distant, on the low bluff overlooking the river. Here the excess of liquid that flows out with it is allowed to leach away into the dry porous soil, and the residue is covered (at intervals of about two or three days) with a light layer of dry loam, muck, or other absorbent, whereby it is rendered odorless and innocuous, and its fertilizing value developed and preserved. Before the next discharge is to occur, it is in suitable condition to be carried away, and composted with more absorbents, or applied directly to the land, with results which demonstrate its agricultural value. In practice, with the present population served by these works, numbering about 650 convicts, and upwards of twenty officers' families, and disposing of about 100,000 gallons of sewage daily, the sludge is discharged once in two weeks. The accumulations of that period furnish a deposit of from eighteen to twenty inches deep upon the bottom of the receiving chamber, and floating matter to a thickness of from six to ten inches upon the top of its contents. After a thorough agitation with a pole, through a manhole, during which about one-half to three-fourths of the floating matter sinks, the discharge valve is opened and the entire contents gravitate into the sludge-pit, which has been made ready by cleaning out the preceding charge, and loosening up the bottom to facilitate the leaching away of the excess of liquid as already described.

Two open sludge-pits, each about 12x40 feet, were originally constructed, to be used alternately, but one has recently been found to serve the purpose, after covering it with a substantial building to exclude rain and snow, and to confine the odor occurring temporarily during the flow of the sludge into it. Although situated within from 150 to 400 feet from six double houses occupied by officers of the prison, the resident engineer states that no complaints have arisen therefrom since it was so housed.

Over one of the small compartments, A', of the receiving chambers, a small pump-house is built, the walls of the compartment constituting the foundations of the building. (See "Plan of Pump-House," also "Vertical Section on E F." Plate II.)

The pump-room contains a small Knowles tank sewage-pump, having its steam cylinder eight inches and plunger ten inches in diameter, with a twelve-inch stroke, and connected with an upright tubular boiler, thirty-six inches in diameter and seven feet high—both pump and boiler being constructed expressly for these works. The pump has two suction-pipes, *c* and *c'*, whereby the sewage may be pumped directly from either chamber, A' or BB, whence it is delivered through a six-inch iron force-main to the various points at which it is to be disposed of by irrigation. It is discharged through common fire-hydrants made with one specially large nozzle, and two hose-nozzles of ordinary size. Two sewage hydrants are placed within the prison yard, where large quantities are used for the irrigation of its sandy soil, and two more outside the enclosure upon the highest points of the arable land of the prison farm and at distances of about 400 and 600 feet from the driven wells. (See Plate I.)

Here the sewage is used in broad irrigation upon such desirable crops as are best fitted for cultivation therewith—chiefly grasses and grains, as well as general tilled crops to a limited extent. The soil, being light, free, and sandy, with the natural water-table at a considerable depth below its surface, is evidently well adapted to receive the sewage, which it does with great benefit to itself, and without complaint of odor or appearance of disagreeable results of any sort, and this notwithstanding the fact that the methods pursued for its distribution are still somewhat crude. The sewage is received at an elevation of several feet above the ground, into a line of wooden troughs supported upon light "horses" or portable trestles, graduated in height so as to secure a suitable fall toward the points of final discharge, and is often allowed to run two weeks, during the hours of pumping, in one place without change.

Undoubtedly a more convenient and economical, and certainly a more sightly management of the sewage would be effected by suitably grading the surface of the utilization grounds, and constructing shallow open conduits and surface channels, provided with suitable contrivances for deflecting the flow toward any desired part of the field, and through which the sewage would be distributed by gravity and regulated at pleasure.

The inconvenience of moving the present arrangement of troughs and trestles affords a potent temptation to unduly prolong the time of flow in a single place. The duration of flow in one place, under the more convenient system of distribution, could wisely be limited to not more than four days, on even so free and dry a soil, and while the works were not originally so constructed by reason of an inadequate appropriation, later recommendations for reforming the methods of distribution in accordance with the foregoing suggestions have been made to the commissioners, with the offer of gratuitous professional assistance in carrying them into execution. The absence of any particular sanitary motive or necessity, however, for pressing such improvements, may perhaps be held to be a reasonable excuse for neglecting to make them.

The new drains, with a minor exception, are laid in straight lines, with a manhole at every junction and at every change of direction or grade. The ventilation of the sewers is insured by the admission of air through perforated covers upon certain of the manholes, whence it circulates to and through the soil-pipes which are carried through the roofs of the prison buildings—the soil-pipes of the "strong rooms" also having been so extended in conjunction with the work done under the Act of 1883, with the direct result of entirely obviating the presence of objectionable odors and sewer emanations which had occasionally existed before.

The ventilation of the receiving and separating works is effectually accomplished without objectionable results of any sort, by the constant admission of air through a perforated manhole cover, *v*, into the primary receiving compartment, A, and its positively induced circulation through a series of openings connecting all the compartments above the level of the sewage therein, and leading, by a suitable arrangement of dampers at the base of the furnace, into either the fire-box under the boiler, or the chimney directly over the boiler, where the gases may be burned, the draught of the chimney in either case effecting the necessary circulation.

The officers' houses upon Commonwealth Row were furnished with water-closets, and together with the warden's and deputy-warden's (now superintendent's) houses, were connected with this system of works during the months of August and September, 1885, through sewers shown upon Plate I, the expense for this addition being paid out of the general appropriation for the Reformatory.

Storm-water is excluded from the new sewerage-works, except in the case of that admitted for flushing purposes by the conductors upon the two houses at the heads of the Commonwealth Row sewers, and also through connecting conductors near the heads of some of the principal drains within the prison-yard.

To prevent any back-flow of sewage, in case the contribution of storm-water by these connections should be excessively large during the night when the pumps are not ordinarily in operation, a safety overflow, *d*, is provided, whereby the excess automatically escapes into the sludge-pipe, and thence passing by the sludge-pits, is discharged into the river. No considerable quantity of objectionable refuse can so reach the stream however, inasmuch as such overflow takes place as already stated at night, when not only is the amount of normal sewage at its minimum, but the overflow itself consists of the secondary contributions of the storm-water, after its primary flow has cleansed the sewers and discharged its scourings into the receiving-chambers.

With the present consumption of water, amounting as already stated to about 100,000 gallons per day, the night flow of sewage from about 5:30 P. M., when pumping usually ceases, to 7 A. M., when it begins again, fills the sewage reservoirs to within about a foot of the overflow level, or from 80 to 85 per cent. of their full capacity of about 28,000 gallons. The pumping continues from about 7 A. M. to 10:30 A. M., and again from 3 P. M. to 5:30 P. M. daily, at which time it is left empty, ready for the night flow. The large consumption of water and consequent delivery of sewage during the night, and indeed at all hours of the day, is largely due to the practice, by a large number of the convicts, of so placing a small bit of wood or other material under the seat of their water-closet as to cause it to flow with a constant stream, thus maintaining a sense of cleansing and purifying efficacy, which is only imaginary, at the expense of a considerable waste of water, and the disposal of it in the form of sewage.

The winter care and management of the sewage does not differ in any essential degree from that at other seasons of the year, nor does it present any peculiar difficulties or annoyances. The comparative warmth of the sewage enables it to find its way into the ground before freezing to any injurious extent, while the sludge-pit, being covered by a close house in which a quantity of dry absorbents is stored, is managed without difficulty.

All labor required in the management and operation of these works is done by convicts. The annual expense of running them may be approximately stated as follows—the labor being rated at what would be its fair valuation under normal conditions of employment:

55 tons soft coal, at $4	$220.00
Salary of attendant	600.00
Repairs and sundries	80.00
	$900.00

The cost of taking care of the sludge-pits and utilization grounds would be additional, but it is doubtless more than repaid by the purely agricultural value of the sewage pro-

ducts to be cared for and disposed of, under any rational system of treatment.

Most of the conductors disconnected from these works have been reconnected with the old brick sewers, whereby a complete double and separate system of sewerage is provided—the storm-water thus finding its way into the river.

The dye refuse and washing-water from the hat shops, amounting to about 50,000 gallons daily, was disposed of by an independent method, having been collected and carried by a six-inch pipe sewer into a pair of open filter-beds or sinks containing each about 500 square feet, and situated on the slope of the bluff east of the prison-yard, where it soaked away without unsightly or unpleasant consequences. These beds or sinks were made in duplicate to enable the bottom and sloping sides of either one to be raked over, and the nearly impervious deposit of felting fibre thereon to be removed, while the other was in use. The removal of the hat industry last year led necessarily to the abandonment of this branch of the works, which is not therefore shown upon the accompanying plans.

The water from the purifiers of the gas-works, under an arrangement made by the resident engineer of the Reformatory, flows into an open rectangular pit behind the gas-house. Across one end of the pit is a brick partition having an opening through it below the level of the liquid standing therein. The gas liquor first enters the larger compartment where the oil and light combustible compounds which are brought along with it, gather upon its surface, and remain therein while the water itself flows through the submerged opening in the brick partition into the smaller compartment. From the latter it flows out though a submerged pipe orifice into a drain leading into one of the old brick sewers, and thence into the river. The combustible supernatant matter remaining in the larger compartment is regularly burned off twice a month.

The removal of the picture-molding shop, which was in contemplation at the time of building the new works, has since been carried into effect, thus taking it out of the drainage problem.

The introduction and operation of the new drainage works has promoted not only the apparent wholesomeness and neatness of the prison and its immediate vicinity, but also the ease and convenience of disposing of all forms of sewage matter. The resident engineer affirms, indeed, that while steam-pumping has been substituted for gravitation, for the removal of the sewage proper, the labor involved in the care and operation of the new system is not only less than before, but it is of a far more agreeable nature. These works may serve, furthermore, to demonstrate, upon a limited scale, at least, the general merits of the utilization of sewage by broad irrigation—first, in point of cost of works and their operation; second, as satisfying the requirements of sanitary principles; third, as a source of revenue in the production of farm crops; and finally, as a means for permanently maintaining the fertility of the soil.

RECENT WATER-WORKS CONSTRUCTION. No. X.*

WATER-WORKS OF GARDINER, MAINE.

THE city of Gardiner, in Kennebec County, has recently secured, through the Gardiner Water Company, a system of water-works, after plans by M. M. Tidd, C. E., of Boston. The city is located at the junction of the Cobossee Contee Stream with the Kennebec River. The stream drains a water-area of perhaps fifteen or twenty square miles, which includes Lakes Androscoggin and Maranacook and Winthrop and Belgrade Ponds, falls in its passage through and by the city a distance of about 126 feet, and allowing no less than eight dams to be thrown across it in the last 1½ miles of its course. At the uppermost of these dams is located the pumping-station, where the head available for power varies from eight to thirteen feet, so that the stream furnishes both water-power and water-supply. A 36-inch R. H. Hercules turbine wheel made by the Holyoke Machine Company, of Worcester, Mass., drives a 12x12 duplex-geared Blake pump, and the relative positions of the essential parts of the pumping plant are shown in Fig. 2.

The pump-well and wheel-pit are built upon the rock-bed of the stream, and coffer-dams were found necessary in construction. The stream is navigable for something less than forty miles above the pumping-station. The pumps deliver through some 2,000 feet of 12-inch pipe into a 2,000,000-gallon reservoir, the same line of pipe doing duty as a leading main from the reservoir, because the pumping-station is between the reservoir and the town. This reservoir in its construction is essentially like the one built by Mr. Tidd for Hyde Park, Mass., and illustrated on page 129 of our issue of January 7, 1886. The city is piped with about ten miles of cast-iron mains from 4 to 12 inches in diameter, carrying 50 hydrants and a full complement of stop-gates and blow-offs.

The low temperature prevailing during the winter has rendered special precautions against freezing necessary, and we illustrate in Fig. 1 the method designed by Mr. Tidd to protect the 10-inch pipe at the bridge-crossings.

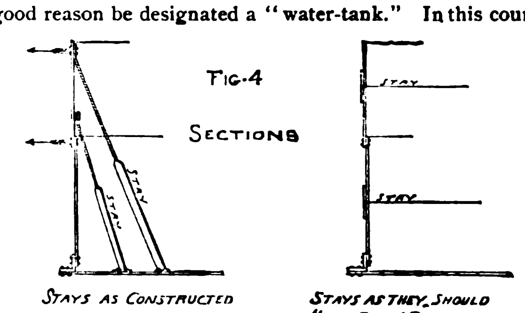
The company began to supply consumers in November, 1885. The service-pipes are of tarred wrought iron, and the works are managed by J. S. Maxey, President, Weston Lewis, Treasurer, and John F. Nash, Superintendent. The contractor was J. J. Newman, of Providence, R. I.

* No. IX., the Water-Works at the Lawrenceville, N. J., School, as published in our issue of December 4, 1886.

BURSTING OF THE GRAVESEND WATER-TOWER, AMERICA.

LOCAL GOVERNMENT BOARD,
WHITEHALL, November 5, 1886.

SIR: To commence my remarks, I must say that I do not understand how the structure under consideration can be properly called a "water-tower." It might with as good reason be designated a "water-tank." In this country, England, we should call it a "stand-pipe," as this is what it was—namely, to give pressure in the water-mains, I assume. If I understand the details as shown in Fig. 4, the weakness of the construction stands revealed in the diagonal stays, which were not stays capable of resisting outward or horizontal pressure. That they would not do so ought to have been self-evident at sight. To resist horizontal pressure the stays should have crossed horizontally and should not have been secured to internal flanges or brackets, but have run through the plates to large outside washers, so that the bursting strain would have been resisted by the tie-rods and washers and not by the structural plates.



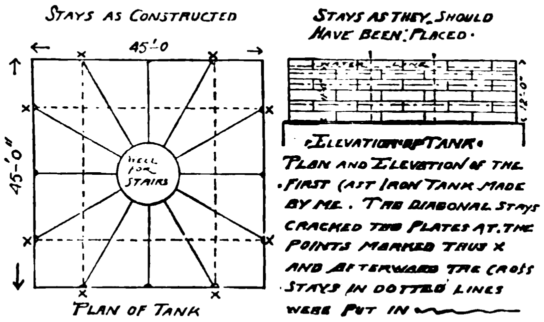


Fig-5

I have constructed and erected some large water-tanks of cast-iron plates (Fig. 5), placed on stone or brick towers, and to contain eleven feet depth of water; there are three tiers of cross-stays, beside the top rim of the tank.

ROBERT RAWLINSON, C. E.

P.S.—What is to prevent the angle-stays being rotated outward by the pressure, as indicated by the arrows? (Fig. 4.)

Cross-stays would have to be broken before rupture could take place.

If in place of the angle-stays there had been gusset-plates there would have been some strength, but even then cross-stays should be added.

[In reply to the above communication of Sir Robert Rawlinson, we should explain that its non-appearance before is due to the fact that it was mislaid in our office for several weeks.

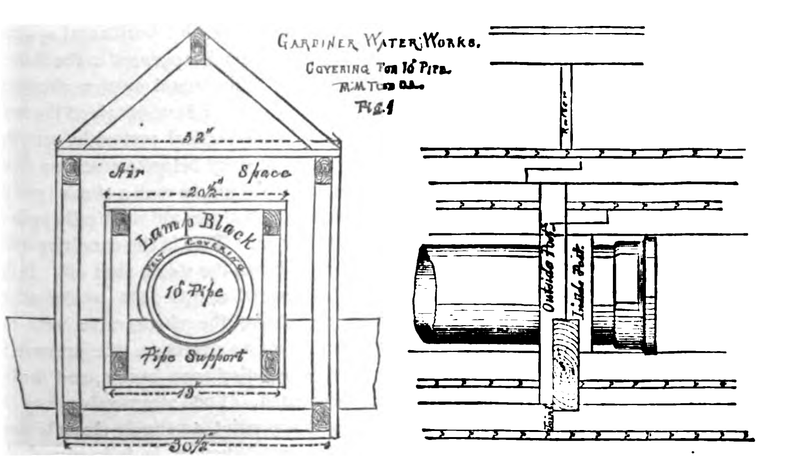
The article to which he refers appeared in the issue of THE SANITARY ENGINEER AND CONSTRUCTION RECORD of October 23. It will be seen that the queries in his postscript refer to the strain on the stays, and the probable change of form at the lower angle. After the article had been published it was rumored that the stays were not put in until after the first filling of the tower. At this filling, it is said that after a certain height had been reached the outer angle at the bottom rose from the foundation three-quarters of an inch. It will be seen by examination that, with a pressure of 100 pounds per square inch at the base, the total pressure on a circle 16 feet in diameter would be 2,895,000 pounds, but there would be a lifting force exerted on the conical portion of the tower of about 1,500,000 pounds. This force had nothing to resist it but the water-pressure, and was transmitted through the shell of the tower to the bottom plates. To balance it required the pressure coming on 104 square feet of the bottom, or an annulus of about 2½ feet in width. It is very evident, therefore, *why* there should be a lifting and deformation at the angle. It is quite possible that if the information as to absence of stays be correct there may have been incipient rupture of the angle-iron at this first filling. After the stays were in place, there being 48 of them, the strains on them, if equally divided, would be

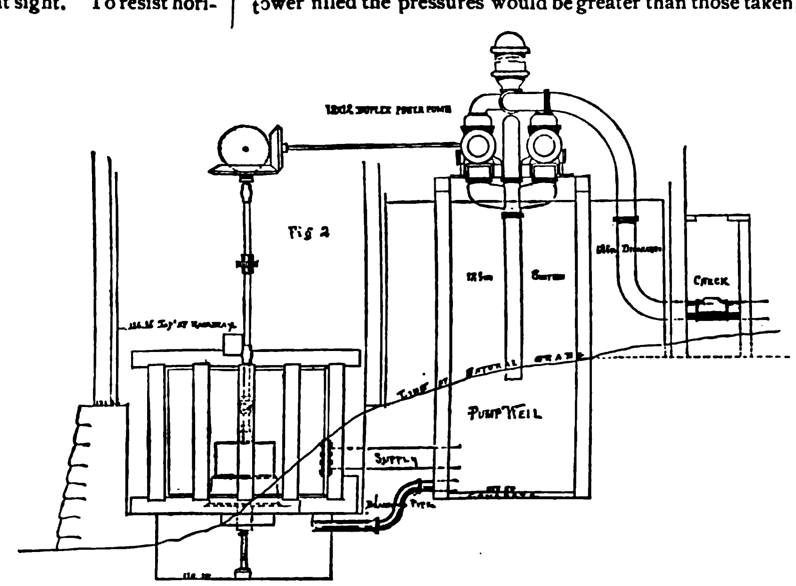
$$\frac{1{,}500{,}000}{48} \times \frac{\sqrt{72''^2 \times 20''^2}}{72''}$$

for the shorter, and the same quotient multiplied by

$$\frac{\sqrt{102''^2 + 40''^2}}{102''}$$

for the longer, giving 32,550 pounds and 33,580 pounds respectively. As these had each 2½ square inches section they were strained nearly 13,500 pounds each. Their lower ends were held by two 1⅛-inch bolts. These would have a net section at the bottom of the threads of about 1¼ square inches for the two, and would be strained nearly 27,000 pounds per square inch, or beyond the limit of elasticity for good iron. Of course, the weight of the tower itself would tend to diminish this strain, and would make a difference of about 10 per cent. On the contrary, were the tower filled the pressures would be greater than those taken,





as 245 feet filled, or 5 feet from top, would give about 111 pounds pressure.

The use of a tank of larger dimensions placed on a tower, as suggested by Sir Robert Rawlinson, would obviate these extreme pressures and heavy strains.]

FOREIGN ENGINEERING.

An improvement in boiler-heating has been invented by the Howaldt Brothers, in Kiel, with a view to getting rid of a portion at least of the unequal temperatures so destructive to boilers. This is applied more particularly though not exclusively to boilers having a lower water-leg running below the ash-pan, and consists in placing in this leg, or generally speaking in the lowest part of the boiler, a radiator of any convenient form to which steam is led from the steam-space above and from which the condensed water is led off to the boiler-feed either by a hand-cock or by a self-acting trap.

In an experiment tried on the mail-steamer "Adler" between Kiel and Copenhagen, the temperature of the lower part of the boiler mounted to 278° Fah. with the apparatus, while the temperature in the other boiler unsupplied with the contrivance only rose to 95°, which indicates not only a decided economy in wear and tear, but also some in heating.

The Berlin Water Company, which supplies the western portion of the city from Lake Tegel in the outskirts, which is chiefly fed by springs, supplies 11,352,000 gallons per day. This supply, which at first proved excellent in quality, unhappily did not remain so long, owing to the combination of a species of fine water-weed (*crenothrix polyspora*) with the iron which impregnated this water to some extent. This soon thickly covered the inside of the pipes, and upon attaining a certain thickness was detached by any slight increase in velocity of the current, choking up the taps and presenting when extracted a by no means pleasant appearence. All efforts in the way of introduction of light and air into the reservoirs having failed to counteract this evil, the company finally had to resort to filters. These, with a thorough preliminary washing out of the pipes, have proved successful in arresting the difficulty.

From "Glaser's Annalen" we extract the following statistics of the relative cost of operating gas-engines and Davey condensing engines:

Gas-Engine per horse-power per hour.		*Davey Engine per horse-power per hour.*	
Gas at $1 per M	0.03	Coke at 0.18c. per lb... ..	$0.0061
Cooling water at 0.01c. per gall	.0025	Cooling water at .0025c. per gall...............	0.0125
Cylinder oil at 5c. per lb...	.0007	Cylinder oil	0.0000
Other grease at 3c. per lb..	.0004	Other grease.......... ...	0.0004
	$c.0336		$0.0190

The Davey engine above referred to is a very compact little condensing engine, in which the steam-pressure is kept at or below the air-pressure, the motive power being obtained by the vacuum produced in the condenser. The boiler, fire-box, engine bed-plate, and condenser are all cast iron, the three former, including the cylinder-jacket, being all cast in one piece, to which is bolted the condenser and the air and circulation pumps. The boiler-feed is entirely automatic by means of an ingenious float attachment.

The apparatus by its safety and cheap operating cost seems to meet a want in small workshops and large houses or farms, for doing all sorts of miscellaneous work. It is made in sizes of ½, 1, 1½, 2½, 4, and 6 horse-power, by Hathorn, Davey & Co., of Leeds, England, by whom it has been patented.

AN OLD PUMPING-ENGINE.

The August number of the "Proceedings of the Union of German Engineers" contains, says the *Engineer*, an interesting account of the first steam-engine built in Germany, and probably the first machine of the kind ever seen in that country. It was erected from the designs of Bergassessor Bückling, who had been deputed to visit England for the purpose of studying the best examples to be found, and it was first set to work at the König Friedrich mine, near Hettsteat, Thuringia, on August 23, 1785. It was single-acting, the cylinder having a diameter of twenty-eight inches, and the valves worked by a plug frame suspended from a huge beam provided with arch-heads in the manner usual at that period. It was, in fact, a very close copy of the Watt type of engine then prevailing. The machine does not seem to have been a success; for the boiler gave way and the engine came to a stand-still. On investigating matters, a "mountain twenty inches high" was discovered inside the boiler, the feed-water being of a highly calcareous nature. A new boiler was accordingly provided, but still this engine could not keep the water down. Bückling was again dispatched to England, and a larger cylinder of thirty-four inches diameter was ordered at Homfray's foundry at Penydarran, the scene of Trevithick's early experiments. But what was of more importance than a new cylinder, Bückling succeeded in obtaining the services of an experienced engineer named Richard, whose engagement was a matter of the greatest diffiulty, the laws against the enticing of skilled artisans abroad being then in full force. With Richard's help, the engine was reconstructed, and remained at work until 1794, when it was taken down, to be removed, in 1797, to the Hoffnung mine, at Löbejün, where it did duty until 1848. Richard seems to have remained permanently in the Prussian service and to have erected other engines at various mines. A large folding plate is appended to the paper in the *Zeitschrift*, giving a general view of the engine from a drawing made by Carl Eckardt in 1797—that is, subsequent to its removal—together with a number of details to scale. These latter sketches were taken by Friedrich Fricke in 1794, no doubt when the engine was taken down. We hand these names down to posterity in gratitude to the draftsmen for having preserved with so much exactness the particulars of almost every part of a pumping-engine of the last century. Writers on the history of the steam-engine and collectors should note this article, and for their special benefit we give the exact reference, namely, *Zeitschrift des Vereines deutscher Ingenieure*, Vol. xxx., pp. 721-3, plate 24 (Berlin Julius Springer.)

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

IMPROVEMENTS IN STEAM-HEATING.*

The two objections to steam-heating are water-hammering and absence of control of temperature. The first is the result of bad design or workmanship, or of mismanagement of the valves. I shall try to show how both can be obviated. The circulation depends upon gravity, and upon very slight differences of pressure in the several parts of the apparatus, this difference of pressure having no necessary relation to the boiler-pressure. Whether the boiler-pressure be ten pounds or one hundred pounds, the circulation is not affected, except that difficulties may arise from a difference in the rate of condensation, which is greatly increased by greater pressures, since high-pressure steam has a higher temperature than low-pressure steam. The flow of steam through the great length of pipes, necessary in most cases, is attended by friction and a consequent reduction of pressure at remote points. In a well-proportioned apparatus these reductions of pressure will be very slight, and, when they are sensible, suitable arrangements must be made to overcome their effects. [The speaker then explained some diagrams on the board, bringing out the points mentioned above.] If the pressure were the same throughout the apparatus the water would be level, but when the circulation is going on, with a diminished pressure in the radiator, it is clear that the level of the water in the return-pipe will rise to a height above that in the boiler equal to the height of a water-column which balances the difference of pressure. For example: if the difference of pressure between the boiler and radiator is one pound, the difference of level will be two feet three inches. Where this difference becomes sufficient to sustain a water-column higher than the difference of level between the water-line of the boiler and the lowest part of the radiator, water enters the latter from the return-pipe, and water-hammering begins. In such apparatus this defect can be obviated by limiting the boiler-pressure so as to reduce the difference in pressure on which the height of the water-column depends. In a well-proportioned apparatus this difference will not exceed one pound, while the difference of level provided is usually four feet.

Up to this point we have only supposed one radiator. Let us consider a number of them, horizontally disposed, with a return-pipe common to all, and for most of its length above the water-line. In such a case there would be no appreciable loss of pressure in the nearest radiator, and the steam, passing down through it, would establish the same pressure on the main return-pipe. At the most distant radiator there would be a lowered pressure, consequently the movement in the return-pipe would be toward it rather than toward the boiler. The result would be that the condensation-water, being transferred to the point of lowest pressure, would accumulate there, obstructing the circulation and causing incessant noise.

If we change this horizontal system into an inclined one, a degree of inclination will be reached where the movement of the water, due to gravity, will have sufficient force to overcome the friction of the steam moving past it in the return-pipe on its way to restore the pressure in the more distant radiators, and the water will then reach the lowest point rather than the point of least pressure. If, now, we continue to increase the inclination of our horizontal system until we reach the vertical, we shall have the common type of radiators disposed vertically, with upright rising mains, and the reason circulation is good, notwithstanding a largely reduced pressure, is sufficiently clear.

If, in the horizontal system, the main return is placed below the water-line, the loss of pressure in the radiators will be balanced in the return-pipe by an elevation of the water-columns in the upright branches, and the circulation will be perfect, notwithstanding the differences of pressure.

The details of the apparatus I have described are commonly supposed to be especially suitable to a low pressure—that is, of two or three pounds per square inch; but, since the circulation does not depend upon pressure, the system is suitable for any pressure. In passing, I will say that a high-pressure apparatus, so called, is one so badly proportioned that there can be no return to the boiler of the water of condensation which accumulates at the remotest point, where there is the greatest loss of pressure, whence it must be removed by special apparatus.

It has appeared that, in an apparatus of good design, slight differences of pressure are unavoidable, but that there must be a limit beyond which they must not go. Suppose, now, we limit the boiler-pressure so that it shall not exceed that of a water-column whose height is equal to the difference of level between the water-line of the boiler and the bottom of the radiator. We can then impose an artificial obstruction in the steam-pipe and graduate its flow, even shutting it off altogether, without deranging the circulation in other radiators. This obstruction is the steam-valve, which, under these conditions, we can open more or less, and obtain more or less heat. We cannot usually do this, because the pressure is too high in the case of horizontal systems having the returns sealed by water-columns; and in the vertical systems, the returns not being sealed, there would be a reversed current in the returns if the supply were throttled, steam would flow in from the return-end and the condensation-water would be driven back and retained in the radiator. Consequently, there is no control of the supply of steam and of the heat emitted; the valves must be wide open or tightly closed.

The method of regulating the heat by limiting the pressure, and thus affording a control over the steam-current in horizontal water-sealed systems, has long been known, and ought to be availed of oftener. I have been able to accomplish the same result in vertical systems in the following way: We have seen that the ordinary vertical system is simply a development of the horizontal system, and that the defects of circulation disappeared in the change of elevation, and also that the horizontal system circulates perfectly by sealing the returns. I have obtained the feature of the sealed returns in the vertical system by carrying them down the height of one story before connecting them to the main return, and by placing in each a check-valve at the point of connection, which closes automatically against a pressure in the main return. This is the condition when the radiator connected to it has the steam shut off. If the steam-valve should be opened a little, the condensation-water will accumulate above the check-valve until the height, or head, is sufficient to overcome the pressure in the main-return pipe, when discharge begins, and further accumulation is prevented. The steam-valve may be opened wider, or set at any point, to supply steam to meet the exact demands for it. When it is fully opened, the

* A paper printed in the Journal of the Society of Arts, Boston, by Mr. Frederic Tudor.

water in the branch-return all escapes, and is not again checked until the steam-supply is diminished.

By means of these appliances the great advantage of controlling the heat, without complicating the management, is secured. In fact, the management is simplified, since there is only one valve to manipulate, and it may be left in any position. With the common two-valve system, if the valves are left in a position different from the necessary one, of both fully open or both tightly closed, the circulation will be obstructed, and water-hammering will ensue. A simpler arrangement depends upon the fact that, with a fixed pressure and given orifice, the rate of discharge is uniform; also, that a given condensing surface exposed to a uniform exterior temperature and interior pressure will condense steam to water at a uniform rate. Given the pressure and the size of the radiator, a valve can be constructed which, when wide open, will discharge the same weight of steam in a given time that the radiator can condense. There is no surplus steam to escape into the return-pipe, and to supply radiators by reversed currents entering through the return-end, consequently no return-valves are necessary; and, since the maximum discharge just fills the radiator, a reduced discharge only partially fills it. Heat may be supplied in any quantity desired; hence the "fractional valve."

This valve will be acceptable to all those people who have learned that steam-radiators must be either fully turned on or wholly shut off, and have asked why we cannot turn on steam just as we do gas or water, and graduate the discharge in a similar simple way.

In conclusion, I think I may say that the ground we have gone over brings us to a point whence we can see the two main objections to steam-heating overcome; we can prevent noise in the pipes and graduate the temperature, and while we have not complicated the construction, we have greatly simplified the management.

In the discussion which followed the paper, in reply to a question as to the relative values of the different methods of heating—that is, by the old-fashioned fire-place, the furnace, and steam—Mr. Tudor said that undoubtedly the fire-place was the most cheerful, but, on account of the enormous draft occasioned by large fires, the influx of cold air near the floor caused great variations in the temperature at different parts of the room. If this entering air was moderately heated (not too warm as to spoil the draft), this method would perhaps be the best. Heating by a furnace, as compared with steam, is simpler and more manageable, especially in regard to the control of temperature, but it is only suitable to very compact houses, unless several furnaces are employed. Heating by steam gives the very great advantage of transferring the heat to comparatively distant points, and the objection to it is mainly in the lack of control of temperature in the apparatus as generally supplied. The quality of furnace-heating has been much lowered by competition of manufacturers, who now seem to aim to catch purchasers by some taking mechanical detail rather than by general excellence. The most thorough work in furnace-heating is cheaper than the poorest, as well as better, in some cases, than the best work in steam, yet the furnace men have been so occupied by their struggle to sell the cheapest heater in the market that they have lost sight of the fact that they could compete in merits with steam as well as in price.

ENGLISH PLUMBING PRACTICE.

BY A JOURNEYMAN PLUMBER.

No. LXV.

(Continued from Vol. XIV., page 570.)

SOIL-PIPES, ETC. (CONTINUED).

In my last paper I described a shaft in which all pipes were fixed, and spoke of ventilation. I here introduce a sketch plan (see Fig. 1) of one set of sanitary arrangements that I saw a few weeks ago at a convalescent home for discharged hospital patients. The whole arrangement was one of the best I have ever seen, and it took some time to find out the cause of erysipelas amongst one section of the inmates. This was eventually traced to defective workmanship arising principally from the settling of the ground in which the drains were laid. The water-closets were placed at the further end of a projecting wing, and a lobby intervened. Each side of the lobby were windows, on opening which a current of air could pass through, and thus insure a cross-ventilation. The fittings in the next room speak for themselves. Another narrow lobby, with cross-ventilation, intervened between the lavatory and the wards in which the inmates slept. Ground is too valuable in towns for building houses with back additions as shown at Fig. 1, but in a great many instances the water-closets could be placed with an intervening lobby as shown, and it is always advisable to do so whenever possible.

To return to our soil-pipes. Figure 2 is a sketch elevation of five ranges of water-closets, three only of which are shown, fixed by the writer and other plumbers working with him several years ago. The work was designed by an eminent sanitary engineer, who has since made a great reputation.

The writer had set out the work as shown on plan Fig. 3, on seeing which the engineer had an alteration made at A, for the reason that should any discharges from the end water-closet flow back it would lie there, and after a time would perhaps entirely choke the pipe and stop all ventilation. The ventilation-pipes to the branch soil-pipes were eventually fixed as shown at B B B, Fig. 2.

Similar work done in recent years by the same engineer had the traps vented as shown by the dotted lines, Fig. 2. As each trap was ventilated, no syphonic action could take place, and neither could the air become so compressed by discharges from a higher level as to have sufficient power

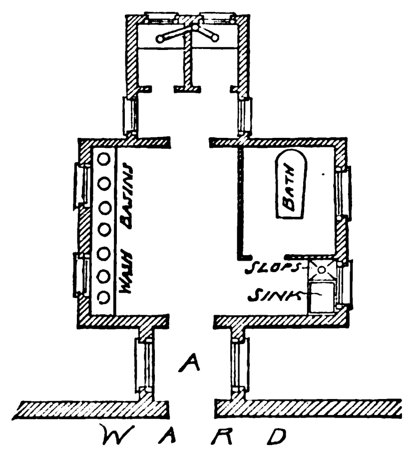


Fig. 1

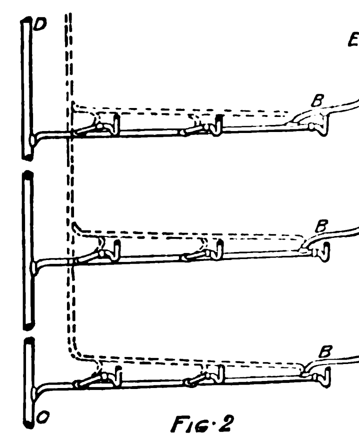


Fig. 2

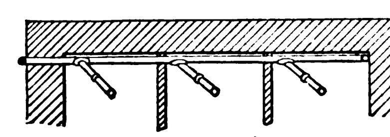


Fig. 3

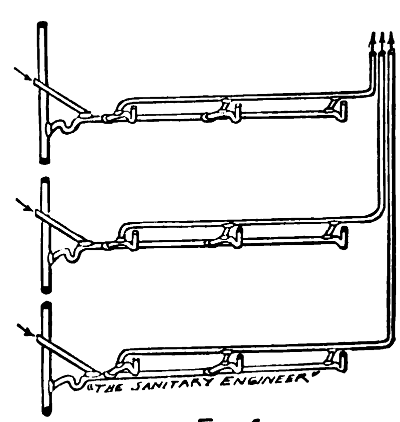


Fig. 4

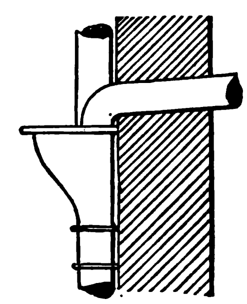


Fig. 5

to break through any of the water-seals of the traps below. Figure 2 presents a good problem for the engineering student to solve as to which way the air-currents would pass, and to what extent ventilation of the whole system of pipes takes place. Take it as shown by firm lines as originally executed. The main soil-pipe C D was five inches, and the branch ventilation-pipe E was four inches diameter. From actual observation made some time after the building was occupied it was found that when none of the water-closets were being used the current was upwards in both pipes, but much stronger from the pipe D than the pipe E. The air escaping at D had only a faint odor, but that escaping at E stank abominable. Why should this be so? The soil-pipe C D, with open end at C, was 60 feet high, and had about 20 feet of vent-pipe on the top end. The soil-pipe from calculation would have about 78 feet 9 inches of internal surface fouled by discharges from the water-closets. The branch soil-pipes were 4½ inches diameter, and were 12 feet long, but in horizontal soil-pipes, from water-closets limited to a 2-gallon flush, only about two-thirds of the perimeter gets fouled. Calculations based on this would give about 49 feet superficial surface exposed, and liable to become furred with the discharges sent through the pipes, and yet these pipes emitted a greater amount of foul air than the main stack of soil-pipes, which had a larger dirty internal surface. Take another view of this matter. I have learned from experience that a vertical soil-pipe will fur up much more quickly than one laid nearly horizontal. A short time ago I found a 4-inch soil-pipe so furred inside that there was only about two inches waterway through, and yet the 4-inch drain from the bottom of the soil-pipe was to all intents and purposes quite clean. Why was this? The discharges down the vertical pipe are met by air which has sufficient power of resistance to break up the falling water, etc., into spray and causing a great deal to trickle down the sides. In the case of the pipe, laid to a gentle fall, the water, etc., flows in a stream on the bottom. This floats the solid matter away and also exercises a scouring force, so rubbing off any little amount of fur that may have accumulated on the bottom side of the pipe. If we accept this reasoning, why was it that more smells escaped from E than from D, which had a larger and fouler internal surface? The answer at once suggests itself. Air entering the vertical pipe at C would pass straight upwards and escape freely at D. The branches would get very little benefit from the air entering at C. But every time one of the water-closets is used stagnant air is put in motion inside the pipes and has an effect on the whole of the system, but it is scarcely possible to calculate what the effect would be. Any one who is good at working out permutations and combinations may perhaps get a good way on the road to an answer, but then other factors would have to be taken into consideration, such as friction and existing air-currents inside the pipes, the state of the atmosphere, etc.

To come back to a more easily understood line of argument, it may be pointed out that to insure a thorough ventilation of the whole of the soil-pipes they would have to be arranged something after the system shown by sketch, diagram Fig. 4. This illustration shows each branch soil-pipe with a trap and air-inlet near the junction with main stack of pipe. At each extremity of the branch soil-pipe is shown an upcast vent-pipe. These vent-pipes should be continued separately to the roof, and not connected with each other, or the object sought would be entirely lost; or the horizontal traps could be done without and a separate soil-pipe carried from each range of water-closets to the drain. Or the argument may be carried still further, and the statement made that each water-closet should have a separate soil and ventilation pipe. But this is going too far, for no sane man would consider the advantages gained

worth one tithe of the cost. Why I have taken these extreme views is to show the importance of carefully studying the ventilation of soil-pipes so as to get the best results at a minimum of cost.

One celebrated London architect disconnects all branch soil-pipes from the main stack as shown by sketch, Fig. 5. Instead of making a soldered joint to the branch and vertical soil-pipes, a hopper-head is inserted as shown. If a building is six or seven stories high, and one or more closets fixed on each floor, six or seven heads would be inserted to receive the various branches. If a water-closet was used on the top floor, the discharge would pass through the whole of the heads on its way to the drain. By the above system thorough disconnection is insured, and there is not the least doubt that each branch-pipe is ventilated independently of the others. Objections have been raised against this way of executing soil-pipe arrangements on the plea that the open heads get splashed with excreta, etc., and after a time give off unpleasant smells which could pass through any open window that may be near.

Another objection that has been raised is, that in frosty weather the heads would become filled with ice. This last remark applies to all soil-pipes that are fixed out of doors. It might perhaps occur in very cold countries, such as North America, etc., but I must say I never knew of but one case where it happened in England, and that arose from the trickle of a small stream of water from melted snow down a rain-water leader that was connected with the soil-pipe. The same result might arise from a leaking closet which allowed a dribble of water to escape into the soil-pipe. Ordinary discharges from a water-closet would pass through the pipe too quickly to freeze, only a few seconds being taken up in the passage of the water, etc., through the pipe.

I presume that in America where soil-pipes which also receive waste-water from sinks, baths, etc., are fixed outside, the frost will have a serious effect by causing an ice block to form inside them. This would not arise from large discharges, but from leaky faucets and small quantities of water that would become congealed as it trickled down the sides of the pipes.

I have noticed at various times in THE SANITARY ENGINEER remarks about the top end of ventilation-pipes being choked with hoar-frost. I never knew this to occur in England on the tops of soil-pipe ventilators, but have seen waste-pipe ventilators partially choked. I have always attributed this to the steam arising from hot-water discharges down the waste-pipes. I should like, through the columns of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, to know if the hoar-frost accumulation round the vent-pipes have ever been noticed on the top of those used for water-closets only, and down which nothing but cold-water discharges are sent.

(TO BE CONTINUED.)

Correspondence.

THE LATE WALTON WHITE EVANS.

WATERFORD, N. Y., December 12, 1886.

SIR: In your notice of the death of Mr. W. W. Evans, the statement is made that he was the oldest living graduate of the Polytechnic Institute at Troy. Mr. Evans graduated in 1836. The catalogue shows that Dr. George F. Horton, of Tarrytown, Pa., who graduated in 1827, is the oldest now living.

Prof. James Hall, New York State Geologist, graduated in 1832. The Rev. Samuel R. House, of Waterford, N. Y., graduated in 1834, and several of other of the earlier classes are still living. Yours respectfully,

J. C. PLATT, JR.

PATENTS FOR HEATING BY EXHAUST STEAM.

PHILADELPHIA, December 3, 1886.

SIR: Will you please inform me in your paper, or otherwise, if there is a patent obtained for heating by exhaust steam from engine by creating a vacuum in heating-pipes, by means of a vacuum pump? If you cannot inform, please let me know the proper person to write to in regard to same. Yours, F. W.

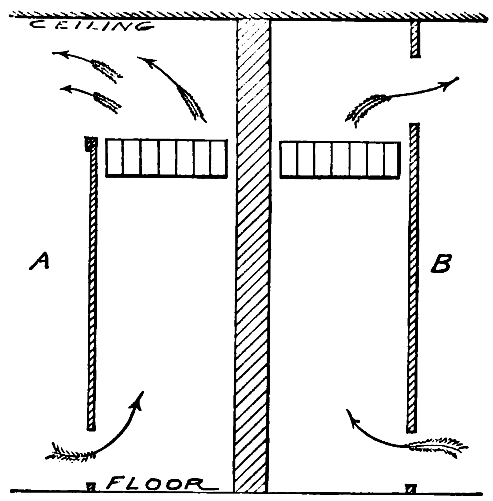
[We refer this question to our readers for a reply, as we know of no one who can maintain a vacuum in a pipe, that should be filled with steam, to be of any service as a heating medium.]

WARMING A BUILDING WITH NO CELLAR WHEN THE BOILER MUST BE ON THE LEVEL OF THE MAIN FLOOR.

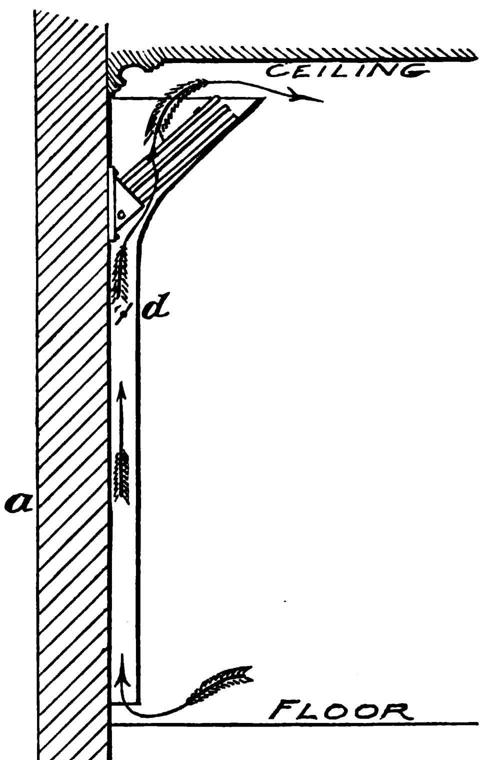
GRAND RAPIDS, MICH., November 25, 1886.

SIR: Your advice to R. W. Symon, of Albuquerque, N. M., can be bettered by having him place his heating-stacks near ceiling, above water-line of boiler, and then encase same with ⅞-inch ceiling or brick, as shown in sketch. This manner of circulation of air produces evenness of temperature and allows water to return to boiler by gravity. The writer has practiced this plan with best of results.

A shows open top with use of register at bottom. B shows casing extended to top with use of register at either opening as may be desired. Only one is needed. Registers



FIG·1



FIG·2

serve a better purpose for controlling heat than valves, as they may be opened to any degree and are prompt in response to demands. "Come West" and profit.

Respectfully, W. C. WEATHERLY.

[Our advice to R. W. Symon, in the issue of November 20, page 596, was what we considered as best under the circumstances. In a small apparatus, such as is used in a private house in which a billiard-room or the like has to be warmed by direct radiation from a gravity apparatus, our advice would be to do it in a manner somewhat similar to that proposed by our present correspondent in Fig. 1. The particulars of our method we show in Fig. 2.

Our reason for not advising it in the case of the court-house is the increase of cost, when applied to a whole floor, compared with the cost of a trap.

The direct heater near the ceiling, involving the principle you show, is a good substitute for a radiator at the floor when the latter is impossible or impracticable, but it certainly is not considered a better method of warming, else why not warm all our buildings in that manner

In the case of a small low-pressure apparatus, however, for one or two rooms on the same floor as the boiler, it is better than a trap, as the latter would be an unnecessary complication that would not work with one-half or one pound pressure of steam, and should not then be used.

The writer of this, who, by the by, received a large part of his experience in the West, has been in the habit for more than ten years of arranging his heaters when completed to put them at the ceiling in the manner shown in Fig. 2, his object in introducing his method here being simply to show how the floor-space may be economized over the method shown in Fig. 1.

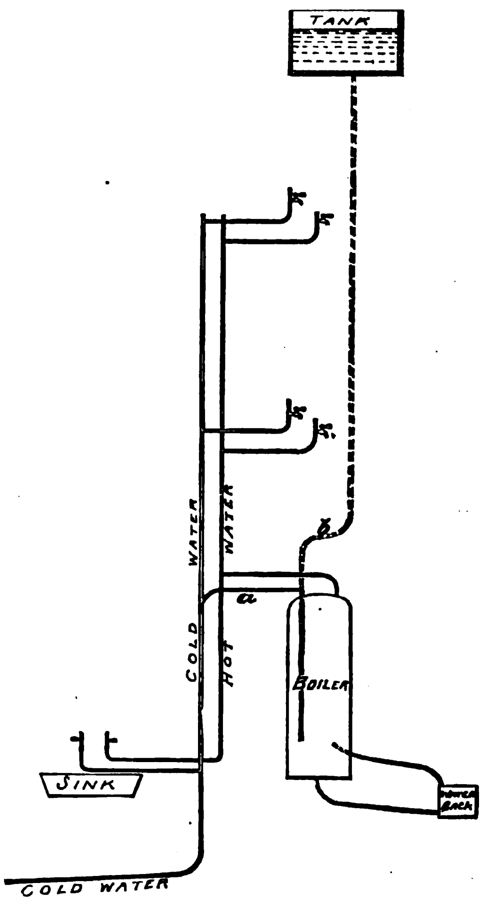
The case is galvanized iron the full width of the radiator, and four to six inches wide, extending to within three inches of the floor, with a damper in the pipe at any suitable position easy of reach. This destroys a small floor-space, say 4x30 inches. A similar plan was carried out by General Franklin at the National Home for Disabled Volunteer Soldiers, at Hampton, Va., with the addition of taking fresh air through the wall at a point about as shown by letter *a*. We think it is also carried out in the Ogdensburg, N. Y., Opera-House, wherein the dressing-rooms are warmed in this way.]

HOT WATER FOR UPPER FLOORS.

NEW YORK, November 30, 1886.

SIR: Will you please give your opinion, with an illustration, of the way I could get hot water on my upper floor? Formerly I had water at all times, but recently it has stopped altogether. I should like to retain the use of my 60-gallon single boiler, and connect the same from tank. I have tank on top floor which holds 450 gallons. Would be extremely obliged for an early answer to this. I remain, J. N.

[If the stoppage of the supply of water to the upper floor is caused by an obstruction in the pipes, remove the obstruction. If, on the other hand, it is due to a loss of



pressure in the street-mains, you will have to connect your tank with the boiler, and cut off the direct connection, in which case, of course, you will have to pump all the cold water into the tank.

The diagram shows the usual pipes for a small house, C W being the cold-water pipes, and H W the hot ones. Put a cock on the hot pipe at *a*, and close it. Then connect the tank and boiler as shown by the dotted line, and put a cock at *b*. Let the latter remain open when you want water from the tank. This arrangement gives you the opportunity to use water either from the tank or street. Never have both cocks open at the same time, or you will lose all the water from the tank into the street service-pipe. If the water will rise into the tank *without pumping*, it will also rise in the house-pipes, and the trouble

must be looked for in some other direction than in the lack of *head*.

If you do not care to take the trouble to turn the cocks A and B when needed, we can suggest nothing other than a double boiler, which is illustrated in "Plumbing Problems," page 147.]

CEMENT-PIPE AT WATERBURY, CONN.

CITY WATER WORKS,
Office of Board of Water Commissioners,
WATERBURY, CONN., December 7, 1886.

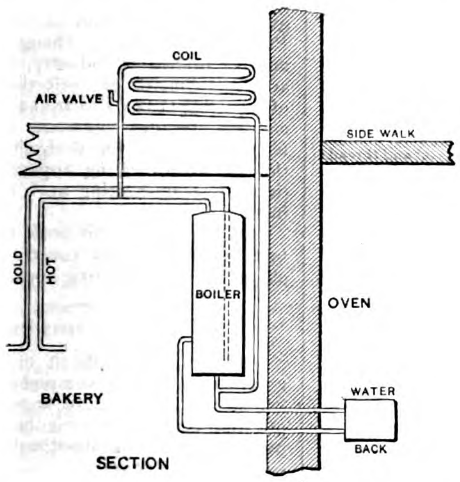
SIR: Our main pipe for water-supply was laid in 1867. It was furnished by the "Patent Water and Gas Pipe Company of Jersey City." Up to 1885 the main has given us very little trouble. Lateral pipes, which were probably laid with less care, have broken at times. The cause of the recent breaks, as well as all of our troubles, is distinctly traceable to defects in the outer coating of the pipes—none from the inner side.

N. J. WELTON, President.

HEATING A ROOM BY A WATER-BACK AND KITCHEN-BOILER.

EASTON, PA., December 11, 1886.

SIR: I saw in your paper of November 20 queries as to warming a room by the water-back. I think it would work by connecting your delivery-pipe from the top of the boiler



SECTION

and passing it around through the coil and down to the cold-water pipe, thence to the water-back again. I also think you want the coil of larger pipe than 1-inch to work well.

Yours, H. B. P.

[The apparatus, as our correspondent shows it, will work, so far as a circulation is concerned, if he puts the air-valve on the highest point of the coil. In the matter of injury to the baking properties of the oven, however, we think it our duty to our readers to warn them against the possible impairment that may follow, knowing which, of course, they are at liberty to experiment as much as they please.]

MEASUREMENT OF WATER FOR IRRIGATION PURPOSES.

THE NORTHERN COLORADO IRRIGATION CO.,
DENVER, COL., November 27, 1886.

SIR: I have to thank you for the explanation in your issue of September 9, and I think it was fully due to the company. There has been no new development in the contest in regard to "water rights"—the opposition waiting, presumably, for the January sitting of the Board of County Commissioners. During the ensuing session of the Legislature, it is very probable that great efforts will be directed to the alteration of the existing laws on irrigation. I do not think anything will succeed.

In regard to Mr. Foote's article on measurement, I would differ with him on the standard, believing as I do that this ridiculous "inch" standard should be abolished. In many other things I could agree with him, but am meantime too busy to prepare a careful letter on the question. Could you inform me, however, of Mr. Foote's location?

If any thing is added to the statute-book in the department of irrigation law, I presume you would have some interest in it, and will take the liberty of sending it to you.

Yours very truly, GEORGE G. ANDERSON.

[The address desired is, "Arthur D. Foote, Engineer and Manager of the Idaho Mining and Irrigation Company, Boise City, Idado."]

PLUMBERS' REGISTRATION IN LONDON.

(From our Special Correspondent.)

IN connection with the movement for the registration of plumbers, a meeting was held during the week, at which Mr. George Shaw, Chairman of the Registration Committee, stated that it had been decided to accept the present standing of master plumbers and journeymen as qualification for registration, subject to any special objections which might arise; further, that journeymen able to produce evidence of apprenticeship to plumbers, and satisfactory employers' testimonials, should be eligible for registration. Seven hundred and two applications from London and provincial masters and journeymen had been dealt with, and several hundreds were yet on hand.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
December 11... .. .	24.73	20.50	20 81	29.83	29.92	22.35	31.62

E. G. LOVE, Ph.D., *Gas Examiner*.

THE City Council of Cleveland, O., has before it an ordinance to cause all telegraph, telephone, and light wires to be laid underground.

IT is reported that the Standard Gas-Light Company, of this city, will use the surplus steam of the New York Steam Company for the manufacture of water-gas. The Standard's pipes have been laid in the same trenches with the Steam Company's pipes.

OF the total population of Great Britain supplied by various water systems (exclusive of the rural population), something like 11½ per cent. are now served through Mr. G. F. Deacon's meter, the use of which as a waste-preventing appliance is steadily increasing.—*Journal of Gas-Lighting*.

THERE is an element in the Dublin Town Council which urges delay in considering the proposition to purchase the works of the gas company, on the ground that at almost any time discoveries will be made in electric-light illumination which will seriously interfere with the gas industry.

IN London the price of gas to private consumers is 3*s*. per 1,000 feet on the north side of the Thames, and 2*s*. 6*d*. on the south side. The charge for public lamps, consuming 5½ feet per hour, is £3 9*s*. on the south side and £3 17*s*. 2*d*. on the north side of the river. It is probable that Parliament will be asked to adjust these prices.

A HUGE iron reservoir is being built at a remote spot in the outer harbor of Amsterdam for the storage of petroleum. It will be nearly 33 feet in diameter, and of the same depth, and is calculated to hold 7,900,000 litres of oil, or nearly 1,740,000 gallons. The petroleum will be brought direct from Russia in vessels specially constructed, which will be pumped out at Amsterdam into the tank, thus saving the expense of filling and emptying casks, and diminishing the risk of accidents.—*Gas and Water Review*.

A FRENCH engineer proposes to make carbonic oxide on a commercial scale by passing generator-gas into a solution of cuprous chloride in hydrochloric acid, such a solution being capable of taking up twenty times its volume of carbonic oxide. The gas is then to be obtained from the solution by vacuum pumps. The expense of this process robs it of any practical value.

THE report of the Superintendent of the Standards Department of the Board of Trade (London) for 1885-6 gives the results of the testing of 63 gas-meters, ranging from 1 to 500 lights. The meters were tested on the consumers' premises, and had not been tested for several years. Of the 63 meters, 27 were correct: 29 registered against the consumer, being from 2.3 to 11.2 per cent. fast, with an average of 4.6 per cent.; and 7 registered against the company. The report very properly says that there appears to be a necessity for a periodical retesting of gas-meters.

WE recently referred to the effort being made to continue the London Coal and Wine Dues after July, 1889, at which time they expire. In this connection we notice that a deputation from the Corporation of the City of London and the Metropolitan Board of Works recently waited on the Chancellor of the Exchequer to ask the aid of the Government in support of the bill to continue these dues. The committee was informed that that the Government was opposed to the measure.

IN order to meet a deficiency of some £9,000 in their gas accounts, the Gas Committee of the Leeds Corporation have decided to recommend that the price charged for gas consumed in the public lamps shall be the same as that charged the general public—namely, 1*s*. 10*d*. per 1,000 cubic feet. A further recommendation is that the discount for prompt payment of bills be reduced from 5 per cent. to 2½ per cent.

PHILADELPHIA ENGINEERS' CLUB.

AT the meeting December 4, President Washington Jones in the chair and twenty-four members present, nominations were made for officers to serve during 1887. Mr. Carl Hering read a paper upon "Analogies Between Electrical and Mechanical Units and Phenomena." The secretary presented, for Mr. A. H. Howland, a paper upon the general subject of water-pipes. Some discussion upon the water-pipe question followed, by Mr. W. J. Hoyt, Prof. L. M. Haupt, Mr. C. T. Thompson, and the Secretary. The secretary announced the death, on November 6, 1886, of William Brantley Cooper, active member of the club, and read from the *Washington County Advertiser*, of Fort Edward, N. Y., an account of his life and work.

ENGINEERS' CLUB OF ST. LOUIS.

THE club held its annual meeting December 1. William L. Seddon, Benjamin F. Crow, Charles W. Bryan, and Otis Breden were balloted for and elected to membership. The secretary then read his report for the past year. The annual report of the treasurer was read, accepted, and referred to the Executive Committee to be audited. The librarian submitted an informal report, stating that there had been no happenings of importance in his department. President McMath read a report from the Executive Committee. It was accepted and ordered filed. Mr. R. E. McMath, as Chairman of the Committee on National Public Works, made a verbal report. There had been no developments. The committee was continued. Mr. Robert Moore, Chairman of the Committee on Fire Streams, reported reasons for no progress. The committee was continued. The committee to whom was referred the letter from the American Society of Civil Engineers, on the subject of changes in that body, reported having drafted a letter which they recommended being forwarded to the American Society as the sentiment of the club. The report was adopted, and the officers of the club were authorized to forward the letter for the club.

The committee on nominations of officers for the coming year reported as follows: For President, William B. Potter; Vice-President, M. L. Holman; Librarian, J. B. Johnson; Secretary, W. H. Bryan; Treasurer, Edward Flad; Directors, R. E. McMath and William Wise. The report was received and the committee discharged. Further nominations being called for, the name of Charles W. Melcher was proposed for treasurer. It was then directed that the letter ballot be taken in the usual way. On motion, the chair appointed Robert Moore, M. L. Holman, and William Bouton a special committee to confer with the Mercantile Library authorities on the subject of permanent quarters for the club.

Charles F. White addressed the club on the subject of furnace efficiency, giving the results of some tests at the Anheuser-Busch brewery on evaporation and smoke prevention. The subject was discussed by Messrs. Breden, Bryan, Monell, Johnson, Bruner, Moore, and Holman. Adjourned.

BOSTON SOCIETY OF CIVIL ENGINEERS.

A REGULAR meeting of the Boston Society of Civil Engineers was held at the Boston and Albany Railroad Depot on December 15, Thomas Doane in the chair and thirty-four members and three visitors present. One member was elected and five applications for membership presented. A paper on "Hydrographic Surveying" was presented by Lawrence Bradford, and the "Acme" cement-testing machine was exhibited and explained by Dwight Porter. A discussion, on the distribution of rainfall by the wind and mountain ranges of the world followed, opened by Desmond Fitz Gerald.

COMPETITIVE DESIGNS.

ARCHITECTS will be interested in the terms of the competition for designs for the public art gallery at Detroit, Mich., which we publish in our Contracting Intelligence Supplement.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

AT a meeting of delegates from Ottawa, Toronto, and Montreal, held in Montreal on the 9th, the constitution was finally settled and a provisional committee formed. Balloting papers for officers will be sent out soon after a list of members has been prepared. It is expected that 300 will join at the start. The Provisional Committee is Messrs. T. C. Keefer, C. M. G., Chairman; H. F. Perley, W. P. Anderson, R. Surtees, J. Kennedy, P. A. Peterson, P. W. St. George, Professor Bovey, Colonel Gzowski, A.D.C. to the Queen; Kivas Tully, W. T. Jennings; Alan Macdougall, Secretary.

COMMISSION ON THE QUAKER BRIDGE DAM.

ON Thursday the daily press stated that the Croton Aqueduct Commission of this city had designated Messrs. George S. Green, J. J. R. Croes, and J. B. Francis a commission to report on the practicability of constructing the Quaker Bridge Dam. As we go to press we learn that this announcement is premature, that the gentlemen named, and also Mr. R. K. Martin, were suggested, but no definite arrangement has yet been made as to their acting in the capacity named. Mr. Rossiter W. Raymond has, as stated, been appointed a member of the commission to examine into the lighting and ventilation of the tunnels, in place of Mr. James T. Gardiner, who declined to serve.

THE Chicago Council Finance Committee has decided to grant $5,000 additional appropriation to the Drainage and Water-Supply Commission for the investigations now being carried on by Mr. Rudolph Hering.

OWING to charges that an inferior grade of stone was used in the facing of the new high-service reservoir at Cleveland, O., the water was recently drawn off to permit an official inspection. Following this the stone facing gave way, sliding down in a complete wreck.

ALLEGHENY, PA., Council has referred to the City Engineer the question of ascertaining the cost of providing public baths for the poor, by converting the Armory Building to that use.

THE State Board of Health of Vermont held a meeting in Burlington, December 7, and organized by electing Dr. A. H. Chesmore, of Huntington, President, and Dr. C. L. Allen, of Rutland, Secretary.

PERSONAL.

SURGEON B. F. POPE, U. S. A., has been relieved from duty at San Francisco and ordered to duty as Recorder of the Medical Examining Board, in New York.

COLONEL JAMES BOONE, a retired railroad contractor, died in Lancaster, Pa., December 13, aged eighty-three years.

COLONELS T. L. CASEY and H. L. Abbott and Lieutenant-Colonel C. B. Comstock, U. S. Engineers, have been appointed a board for the examination of officers of the corps for promotion.

MAJOR H. B. RICHARDSON, Chief of Engineers of Louisiana Levees, and Capt. W. T. Rossell, U. S. Engineers, Capt. D. C. Kingman, U. S. Engineers, and Assistant Engineer H. S. Douglass are making an inspection of all levees on the Mississippi below Memphis, on which the United States Government is making repairs.

JOHN B. ROOT.

JOHN B. ROOT, of the firm of Abendroth & Root, of this city, died on December 11, in the fifty-seventh year of his age. Mr. Root had been a resident of New York for about thirty years. He had a strong bent for mechanics and inventions, and took out some fifty patents. The best known of these were the water-tube safety steam-boiler, and his spiral riveted pipe. He is claimed to have been the first to make a sectional water-tube boiler. He was for several years an active member of the American Society of Mechanical Engineers, taking great interest in its affairs. He leaves a wife and one married daughter.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 4. PUBLISHED EVERY SATURDAY.

NEW YORK, DECEMBER 25, 1886.
LONDON, JANUARY 8, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 140 William Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

OUR SEA-COAST DEFENSES.

THE first number of the new *Scribner's Magazine* contains an article, "Our Defenseless Coasts," by Captain F. V. Greene, U. S. Engineers, which, aside from being admirably written, is strong in its reasoning, and must be of service in making the sentiment necessary to secure intelligent action by our national lawmakers.

The proposition is made that the money to be expended for the protection of our sea-coast cities, and likewise for the cities on our lakes, is after all only an insurance, such as a prudent merchant would take to protect his property from loss by fire. The ability of any foreign nation to land and maintain an invading army is not considered, since that is a contingency not worth contemplation. The whole question is, what is the ability of a foreign power so disposed to destroy the property of the American people, and what is the ability of the United States Government to prevent any power from carrying out such a work of destruction if they were so disposed?

The frequent unreasoning clamor of the Eastern press against river and harbor appropriations as a whole, and the assumption that money spent for the improvement of the Western waterways and the development of the newer portions of our country is money wasted, has had the effect of preventing the average Western legislator from considering the needs of Eastern cities with that absence of prejudice and breadth of view which is so essential. Consequently, it is not strange that Congress has been slow to take any action by which the whole country is to be taxed to protect property in which taxpayers in the Western portions of our country think they have no direct interest. Hitherto the inhabitants of that section have been largely the debtor class, and they have never regarded the destruction of an Eastern city as directly affecting them, as much as the capitalists of Boston or Hartford would consider themselves affected by the destruction of a Western city on whose property they hold mortgages. Captain Greene, therefore, reinforces his arguments by showing our Western friends the possibility of the destruction of the lake cities.

The article, which begins with a brief history of the inception and execution of our present sea-coast defenses, shows what money was spent after the War of 1812, and how much larger the sum then was, considering the resources of the country, than the amount now estimated to be necessary, as compared with our present wealth; and concludes with illustrations and descriptions of several forts in New York Harbor and notable guns and turrets in European fortifications.

Aside from being interesting reading to the engineer, it is suggestive and useful information for every American citizen, and we advise our readers to read it entire, rather than furnish an abstract of an article that is, to us, one of the most notable features of the first number of the magazine which made its advent a week or two ago.

CROSSINGS AT GRADE.

BY a recent article in the Pittsburg *Gazette* we see that the Society of Engineers of Western Pennsylvania are discussing the matter of grade-crossings in relation to the roads passing through Pittsburg. It is stated that hundreds of lives have been sacrificed there at the present grade-crossings, and the time has come when there is no excuse for a continuance of this dangerous system. The remarks made in THE SANITARY ENGINEER AND CONSTRUCTION RECORD last week respecting the crossings in New York City apply equally well to all cities. Railroads are built by the stockholders to make money, but the valuable franchise conferring the right to build comes from the Government as the representative of the people. Whenever, therefore, they are so operated as to unnecessarily endanger the safety of the public, it is the duty of the people's representatives—the lawmakers—to enforce the adoption of such well-known measures as shall remove this danger to the safety of all concerned.

THE VYRNWY MASONRY DAM.

WE have in back numbers of the SANITARY ENGINEER AND CONSTRUCTION RECORD described quite fully this important work, and would refer to articles published on January 28, February 18, April 18, May 13, and June 17 for full information. The dam across the Upper Vyrnwy Valley will have an extreme height above the rock of 139 feet, and a total length of 1,255 feet, and it will form a lake 4¾ miles long, covering 1,115 acres. The lake will contain above the outlet 11,900,000,000 gallons. The masonry is built of rough masses, with rough, flat lower beds, laid up in Portland cement mortar; forming what is called a Cyclopean rubble.

In our present number we give two pages of illustrations. The two artistic sketches show some of the property which will be overflowed by the lake, and are well worthy of preservation for their architectural suggestiveness. To the average American mind, which never realizes the value of water and the iniquity of wasting it, the fact of its value in older countries and the cost and difficulties attending the procurement of a good supply may be suggested when we explain that the subject of our special illustration this week is a Welsh country house or "Shooting-Box" and the village of *Llanwddyn*, both of which are to be submerged on the completion of the Vyrnwy dam.

The middle picture of the three, on page 85, gives a general view of the valley, showing that the land submerged is all valuable as farming land, giving an idea of the expensiveness of the undertaking. The remaining two pictures give a good idea of the appearance of the dam, and the, to us, somewhat novel method of handling materials by the use of revolving cranes instead of derricks. These are on wheels, and can be traversed lengthwise of the masonry.

OUR RUINED STREETS.

UNDER this heading the *Evening Post* gives the result of an interview with Gen. Newton, in which he says: "I would like to see the opening of streets in winter forbidden by law, except under certain conditions. A commission could be appointed to judge whether the work was absolutely necessary, in cases to be brought before them, and in this way we could keep our streets in much better shape." He complains that in some of the most flagrant cases of disregard of the rights of the public he is powerless to act, since the permit comes by special legisla-

tive enactments. It is unquestionably true that if the suggested law were adopted in most of the cases, which now so seriously interfere with the use of the streets, those responsible for them would anticipate their needs so as to do the work before snow and frost interfere with sound work. Only those who have had to wade through the sea of mud and slush recently existing in the lower part of the city can fully appreciate the annoyance and discomfort resulting from present methods. Added to this, the frequent tearing up of the street-surface soon destroys its smoothness, and leaves hollows and ruts in which water and mud collect, and the wear and tear of vehicles is greatly increased.

It is a question whether even a more stringent measure might not be desirable, by which when any company is allowed to tear up the street for laying their plant, whatever it may be originally, they shall at the same time lay connections to each lot as far as the curb, so that when the pavement is restored it shall not require constant disturbance as at present. The experience of New York is in a greater or less degree repeated in every city, and the subject is one worthy of discussion and careful thought.

OUR BRITISH CORRESPONDENCE.

Disposal of Sewage—Small-Pox Hospitals—A Manufacturer of Disinfectants brings a Libel Suit—Registration of Engineers in Charge of Steam Boilers—Electric Motors for Tramways—Conduits for Water, Gas, and Drain-Pipes.

LONDON, December 8, 1886.

I SEE it stated that in connection with the discussion on Dr. Tidy's paper on the "Disposal of Sewage," which was read at the Society of Arts on Wednesday evening last, Mr. Bernard Dyer, the Chemist and Public Analyst, recorded his protest against the statement that any kind of treatment whatever with chemicals at the outfall would prevent the sewage matter from putrefying in the Thames.

The discussion between the Metropolitan Asylums Board and the Local Government Board respecting the small-pox hospital erections still goes on. The position of the Local Government Board is that it is cheaper to erect wooden huts. The Asylums Board, while admitting of course that the first cost is cheaper, point out that good huts for use throughout the year will cost within 20 to 30 per cent. of brick erections; that the repairs will be more than double, and the wear one-third as compared with brick; further, that the brick buildings will not get saturated with infection as is the case with wooden huts. They further point out that the original cost of the wooden huts at present standing in the camp was £48,000 ($230,400), but that, notwithstanding repairs, etc., their value, after eighteen months' standing, was only £12,000 ($57,600). Notwithstanding the strong ground taken up by the Asylums Board, they cannot proceed without the sanction of the Local Government Board.

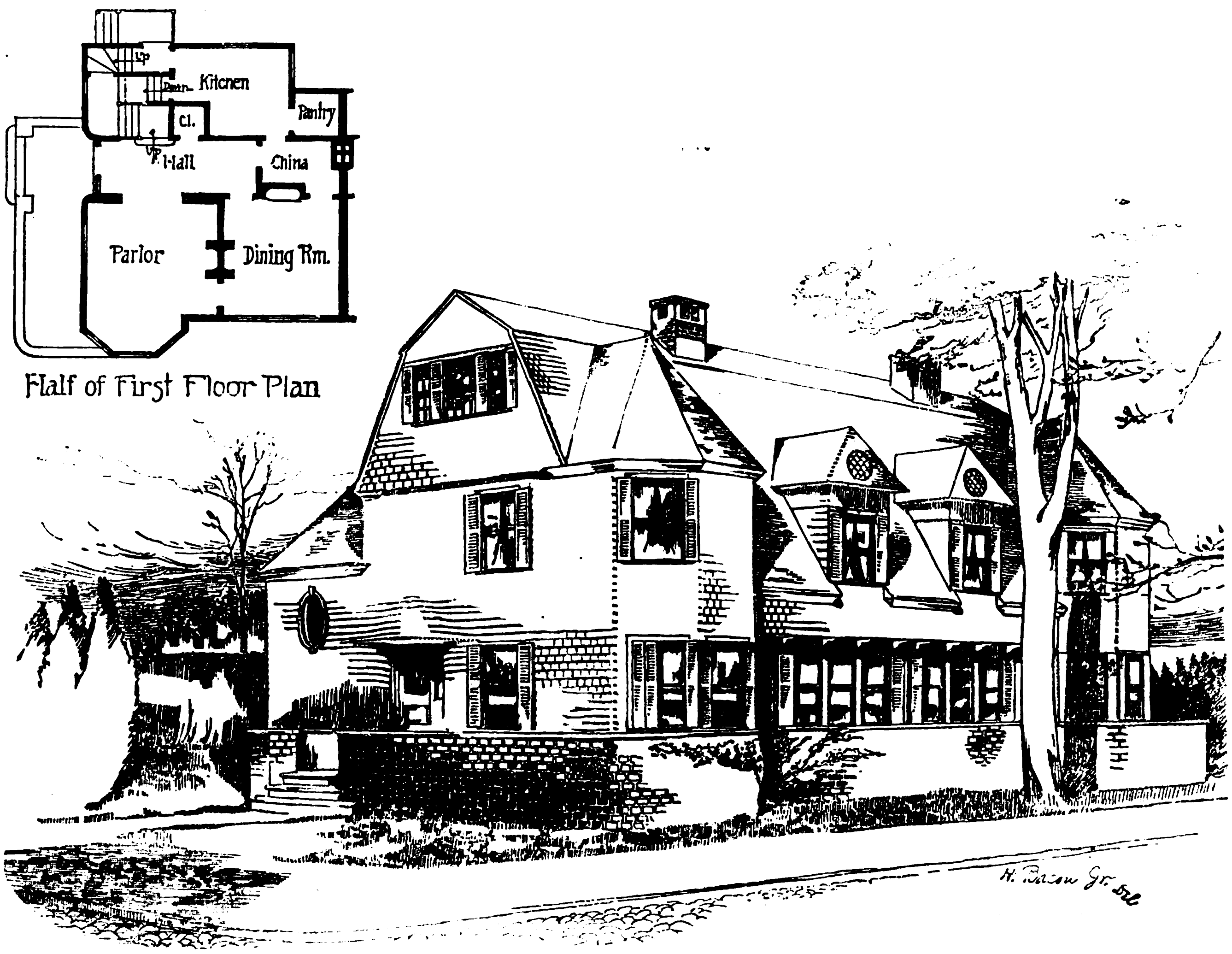
I see that a case is entered for hearing in the law courts for libel, which, if it comes off, will prove of very great interest. A certain manufacturer of disinfectants approached Mr. Strachan, the Surveyor to the Chelsea Vestry, with certain proposals as to using the article of his manufacture. Mr. Strachan considered it to be his duty to report to his board that the said manufacturer had offered him a bribe to adopt his disinfectant. The manufacturer now takes action for libel against the surveyor and the chairman. There is so much of this going on that it is to be hoped the case will be heard.

The frequency of boiler explosions of late has been such that there is an agitation with a view to obtaining legislation calling for certificates on the part of those having charge of boilers, and further for registration and proper examination of the boilers themselves.

The progress of electricity as a motive power has been so far satisfactory that I see that a trading company is advertising, offering to make cars and engines for tramway works.

I notice that in the handsome new streets that are being constructed on the site of the "rookeries" lately acquired and pulled down by the Metropolitan Board of Works in the St. Giles' District—namely, between Piccadilly Circus and Tottenham Court Road and Piccadilly Circus and Bloomsbury—provision is being made for the carrying of the drains, gas and water pipes in underground conduits, similar to those existing in Northumberland Avenue and Thames Embankment. The advantages of this system speak for themselves, and we shall not have the distressing sight of a roadway being pulled up to allow of repairs to pipes underneath, immediately after such roadway has been laid. This is, at present, a frequent occurrence.

SAFETY VALVE.

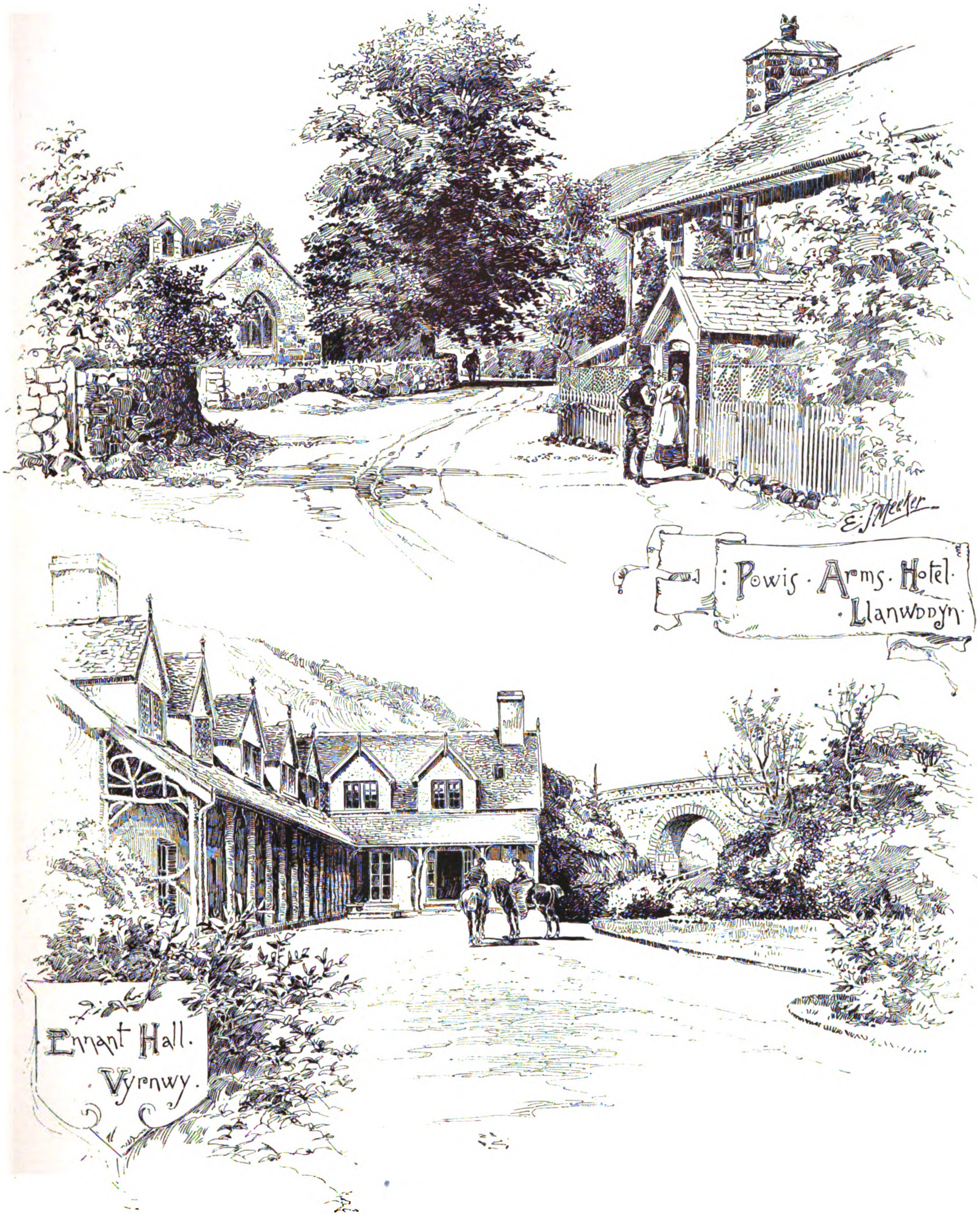


A DOUBLE COTTAGE AT CHELSEA, MASS.—CHAMBERLIN & WHIDDEN, ARCHITECTS.

MEXICAN WATER-CARRIERS.

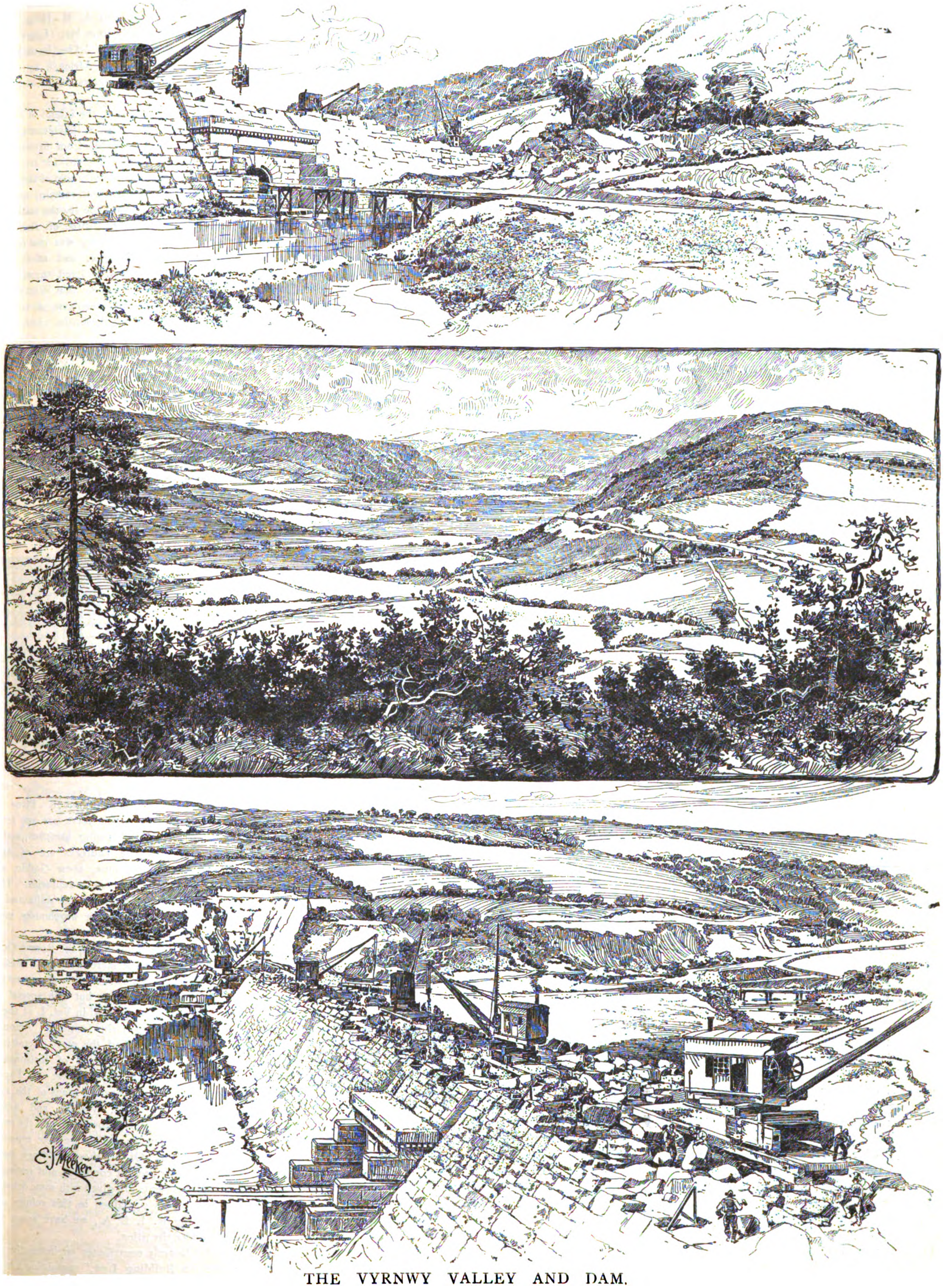
GUAYMAS is built of brick and adobe, the bricks being very large and thin, something like the Roman brick in shape. They are very soft, and although there is no frost to affect them, there is something in the weather which causes them to crumble away almost like so much adobe. The city has no wells, and, as yet, no water-works, with the exception of the pipes of the railway company, from which the houses of its officers, besides its shops and tanks, are supplied. The water-carriers are a curious local spectacle. The public wells are at the upper end of the town, and nude Yaqui Indians may be seen there all the day pulling up the water in buckets, standing on a staging beneath which donkeys are coming and going with enormous sacks of raw hide, riveted and water tight, hanging down almost to the ground on either side. When the donkeys arrive, the bags are flabby and light. The naked Yaqui above pours down the water in a glistening stream, and the skins swell up until they hang heavy and distended, like a full paunch. The donkeys then depart down the street into the town on a slow, deliberate walk, the large water-bags swinging slowly as they go. Scantily clad boys, happy looking and brown as berries, sit astride the hind-quarters and kick their bare heels incessantly against the donkeys' flanks. There is a bullock's horn in the bottom of each bag, and when the horn is pushed up it lets the water out into a bucket, also of raw hide. Water is sold for one real (twelve and a half cents) a bag, or by the bucketful for a cent or so. Altogether these water-carriers are about as oriental in aspect as anything on this continent, and the lover of the picturesque might regret the establishment of the water-works which, with many other new things, are to be introduced under the awakening of the land by railway.—*Christian Leader.*

THE City Council of St. Paul has passed an ordinance making it unlawful for any one to cut and sell Mississippi River ice in St. Paul. The charge has been made that the river ice has been rendered unfit for use by reason of the Minneapolis sewage which flows into the river.

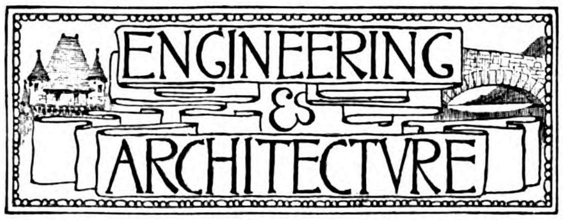


THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

A WELSH SHOOTING-BOX AND VILLAGE TO BE SUBMERGED ON COMPLETION OF THE VYRNWY DAM.



THE VYRNWY VALLEY AND DAM.



OUR SPECIAL ILLUSTRATION.

A WELSH SHOOTING-BOX AND VILLAGE TO BE SUBMERGED ON COMPLETION OF THE VYRNWY DAM.

FOR explanation of our special illustration see the editorial on the Vyrnwy Dam.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

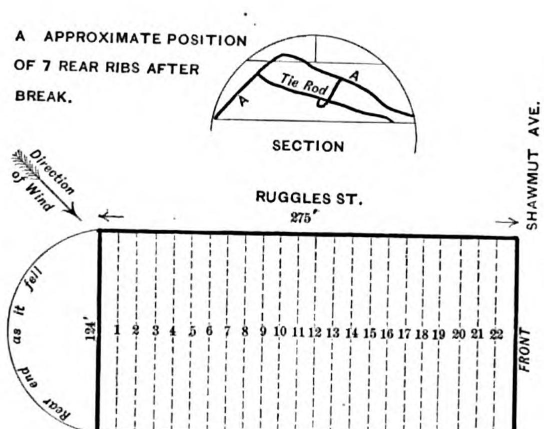
RESIDENCE AT CHELSEA, MASS.—CHAMBERLIN & WHIDDEN, ARCHITECTS.

THE subject of our vignette illustration is a double residence owned by Mr. J. G. Low, at Chelsea, Mass. The exterior is of bench brick up to the first story, and the remainder of California redwood shingles, painted a pale green. The interior finishings are of pine, stained or painted. The architects were Chamberlin & Whidden, of Boylston.

FALLING OF THE HIGHLAND SKATING-RINK, AT BOSTON.

THE Highland Skating-Rink, at Boston, was an exceedingly light structure, and its destruction by snow and wind (which occurred on the afternoon of the 7th inst.) had been predicted for some time.

The building was 275x124 feet, with a total height above floor-line of about 45 feet. It was nearly semicircular in cross-section, with ribs 14x9¼ inches, made up of 1⅜-inch planks of Georgia pine, bolted by ⅝-inch bolts at every 3 feet. These main ribs were 12 feet apart on centres. Between these in each space were three ribs or rafters of 2¾x3½-inch white pine; 2½x5½-inch purlines supported the rafters at 5-feet intervals. The purlines were spiked to the ribs, and were also held by 2x1-inch strips nailed to the ribs. They were omitted at the spaces occupied by the windows; and also to a height of 12 feet in every alternate space between ribs, to make openings for the doorways, each doorway being shielded



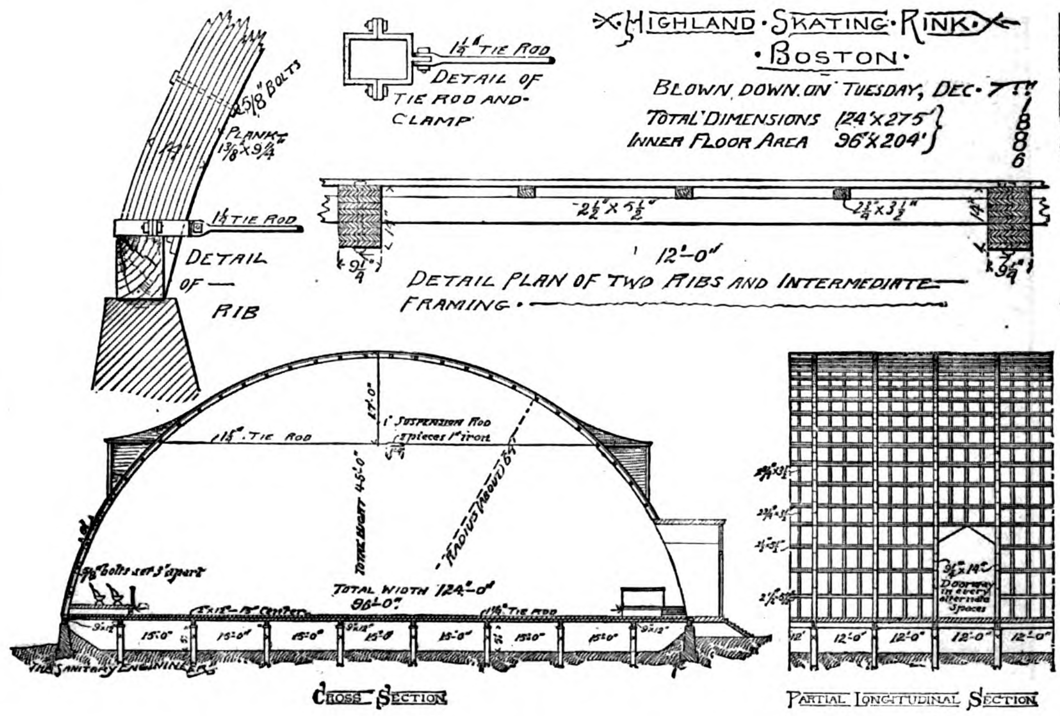
by a vestibule as shown in the engraving. At the middle of the length of the building a portion of one of the main ribs was omitted to make room for the band-stand. The covering was 1¼-inch boarding, with tarred paper outside. At about 17 feet from the top was a 1¼-inch tie-rod to each rib, with a 1-inch suspension-rod at the middle, and below the floor-line a second similar one. These had turnbuckles made of 1-inch iron, for tightening. The floor-timbers were 2x12-inch joists at 15-inch centres laid on 8x12-inch timbers spaced 15 feet apart, resting on posts 8 to 10 inches diameter, at 12 feet apart. The sills were 9x12 inches, resting on a rubble-stone wall 18 inches thick, laid in cement.

The building is on an open lot on the corner of Shawmut Avenue and Ruggles Street. Wet snow had fallen to the depth of nearly two feet; and this had probably reached a greater depth on *one* side of the centre than the other, as a wind was blowing during the storm, in the direction shown by the arrow in the small plan.

About 3 o'clock P.M. the engineer, Mr. W. E. Bertwell, and others saw a Chinese lantern, used in decoration, fall from one of the rafters near the rear end, followed by a sudden crackling sound like the breaking of timber. They next saw a large crack appear in the roof, and the roof appeared flattened at the top. While watching it, more cracking was heard, and a perceptible swaying of the building occurred. They immediately began removing furniture, etc., and a little before five o'clock the tie-rod of rib No. 1 near the north end snapped at the turnbuckles. Our correspondent does not state the exact point, but it was presumably in the thread of the screw on the tie-rod where the net section would be but about one inch in diameter, as it does not seem that the threads were upset. Very soon ribs 2 to 8 caved in on the windward side (next Ruggles Street) and broke about 20 feet from their middle point. Then ribs 10 to 18, including the band-stand, collapsed entirely, leaving five ribs and the front, or about 50 feet of the southern end standing.

The compression of the air by the fall, it is said, gave sufficient force to throw those in the building about 20 feet.

As there was no support to the roof between the ends of the upper tie-rods 90 feet apart, it would seem from this description that the roof failed by deformation at the



crown, followed by sufficient increase of thrust to snap the tie-rod; and the fall once begun, the arches followed one another in rapid succession.

The sketch above the plan shows approximately the shape assumed by the ribs after the collapse.

It is providential that the fall occurred in the afternoon, as a large audience would have been gathered in the evening of that day.

TRANSACTIONS OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

VOLUME II. of the New Series of the Transactions of the Royal Institute of British Architects is a publication that contains a number of papers of great interest and value.

The address of the President, Mr. Ewan Christian, delivered a year ago, begins by recording the then recent death of Professor Donaldson, the well-known founder of the Royal Institute of British Architects, and former Professor of Architecture at University College, London, to whom two other papers in the volume are devoted—viz.: "Memoirs of the late Professor Donaldson," by Edward A. Graning; and "The late Professor Donaldson: His Connection with the Institute," by Wyatt Papworth. After referring to the proposed new charter of the institute, the President goes on to speak of architectural education in England. He has the wisdom to urge strongly the importance of a university course as the foundation for a professional education. But in this connection it is curious to find a eulogistic reference to the "English system" of architectural education. Probably no country professing any great devotion to the art of architecture is so conspicuously *without* an adequate system of professional training in architecture as England is. The address then refers to the restorations in progress at Westminster Hall, the Tower of London, and Peterborough Cathedral, and to the new Admiralty and War Offices and the new bridge over the Thames.

Perhaps the most interesting and valuable articles in the volume are the paper on "Wisby," by William White, with notes by R. H. Carpenter and A. H. Haig, with very complete illustrations, chiefly from Mr. Haig's admirable sketches; and the article on "The Remains of the Roman Occupation of North Africa," by Alexander Graham, with an interesting series of drawings by the author.

Wisby, the principal town of the Island of Gotland, in Sweden, has now only about 4,000 inhabitants, but in the middle ages it counted probably from fifteen to twenty thousand. Its ancient walls are still for the most part standing, and thirty-five out of forty-five of the old towers still exist. The five gate-towers all remain, and three of them are still in use. Toward the sea the wall was without towers, but had four gates, three of which are still used. In the middle ages Wisby was one of the chief ports of the Hanseatic League, and many German, Russian, and Danish merchants lived there, and built themselves churches. So it came that Wisby contained an unusual number, originally seventeen, of which eleven still remain. All but one of these, the cathedral, are in ruins, and one at least is a mere fragment. Plans drawn to scale are given of all of which there are any remains. Judging from Mr. Haig's charming sketches, and from the descriptions given, the churches are of unusual interest. Some are Romanesque, some Gothic, dating from the twelfth to the fourteenth centuries. The old town, close by the sea, with its ancient walls and many towers, its churches and old timber warehouses, must be very picturesque.

The paper on "The Remains of the Roman Occupation of North Africa, with special reference to Tunisia," by Mr. Alexander Graham, is a continuation of a paper by the same author on the same subject, but with special reference to Algeria, which was printed in Vol. I. of the New Series of the Transactions of the Institute. Among the many important ruins described, the most interesting are the great cisterns outside the walls of Kaisonan, the aqueduct of Carthage, the amphitheatre at Thysdeus (which, as is shown by comparative plans of the amphitheatres at Rome, Thysdeus, Verona, and Arles, is second in size only to the Colosseum), and the ruins of the city of Sufetula, among which we note especially a group of three temples. Of all these buildings sketches by the author of their present condition and restorations from careful measurements are given with some details.

Of the other papers contained in this volume of the Transactions of the R. I. B. A., we have space to do little more than note the titles.

Mr. Alexander Beazely contributes an instructive paper on "The Swedish Building Law," containing a number of very curious facts, together with much we might do well to imitate.

The papers of Mr. Gass on "American Methods of Building and Architecture" we noticed at the time they

were read before the institute. There are two papers of much interest, copiously illustrated, on "Japanese Architecture," by Josiah and Roger T. Conder. The volume closes with the proceedings at the ceremony of the presentation of the Royal Gold Medal of the Institute to M. Charles Garnier, the well-known architect of the Paris Opera, and President of the Academie des Beaux Arts of the Institute of France.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. V.

(Continued from page 63.)

RECENT IMPROVEMENTS IN DREDGING MACHINERY.*

It is the purpose of this paper to deal more particularly with the chain-bucket or elevator system of dredging, and to draw attention to its general character and capabilities as compared with other systems.

A study of the best examples of these machines both in use and while building on the stocks on the Clyde, in Scotland, shows that while they contain some features which an American engineer would not care to imitate, they are, nevertheless, of the most solid and substantial character and excellently adapted to their purpose.

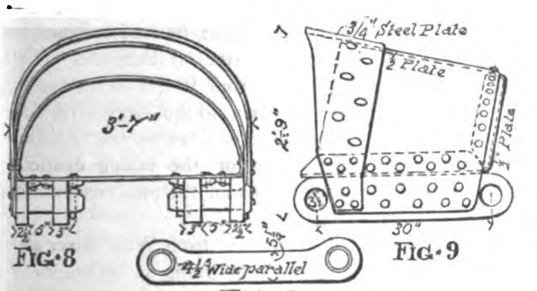


FIG. 8 FIG. 9 FIG. 10

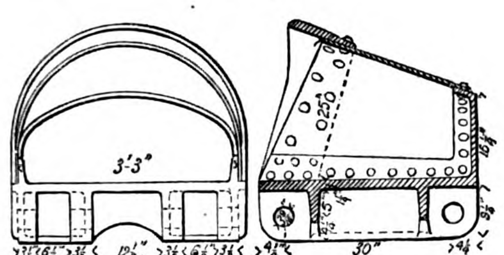


FIG. 11 FIG. 12

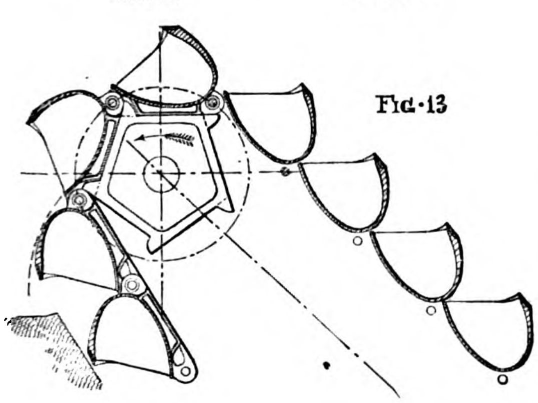


FIG. 13

From published statements of the performance of the dredging fleet belonging to the Clyde trustees, who possess one of the most extensive plants for river and harbor work in the world, it appears that in the year 1882 five of their chain-bucket machines dredged an aggregate of 1,309,300 cubic yards of mud, with some clay, blasted rock and boulders, at a total cost of $66,800, or 5.1 cents per cubic yards. Of this cost, the wages, fuel, and stores formed forty-four per cent. and general repairs fifty-six per cent. These results may be taken as evidence that the chain-bucket, *as a system*, is good. The strong point of the endless-chain machine lies in its continuous action, as distinguished from the intermittent action of the dipper or grapple dredge. The only other continuous discharge machines in use, to the writer's knowledge, are those constructed on the pumping or suction principle. These can only be used successfully where the material to be raised can be made of sufficient fluidity to be pumped. In certain situations the discharge of the material with a large admixture of water is desirable or not objectionable, as where it is pumped on shore to flow and distribute the solid matter over a considerable area. As a rule this is not the case, and for all ordinary conditions and for tough or stony digging it seems to be the most rational method of excavation to handle the material bodily in a properly adapted bucket. The liability of the pumps, etc., to clog, and the friction and abrasion of the interior surfaces of the pumps and connections are difficulties which have not yet been practically solved.

Where the work is of sufficient extent, the chain-bucket machine can deal with large quantities of material at a rapid rate, and cuts a perfectly level bottom.

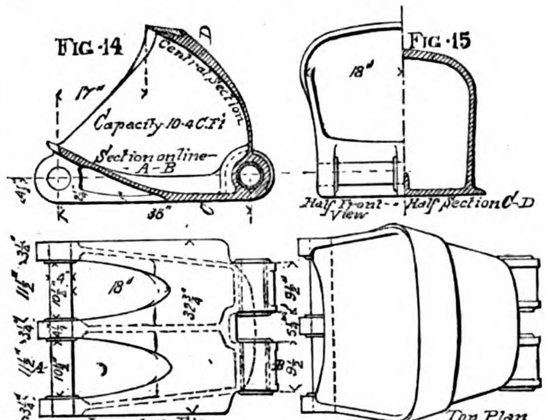


FIG. 14 FIG. 15 FIG. 16 FIG. 17

On the works with which the writer has been connected, it is customary to gauge the water-level and depth of cut to inches, and to set the buckets to cut six inches below the depth to which the channel is afterward tested. So accurately is this done with chain-bucket machines that vessels regularly pass with but a few inches between their keels and the bottom.

The digging action of the chain-buckets takes place in a manner calculated to apply the power to the best advantage, the cutting edges entering horizontally and then curving upward on a short radius, so as to fill the buckets and retain the contents. They are also able to take off light cuts over large areas as efficiently as heavy cuts.

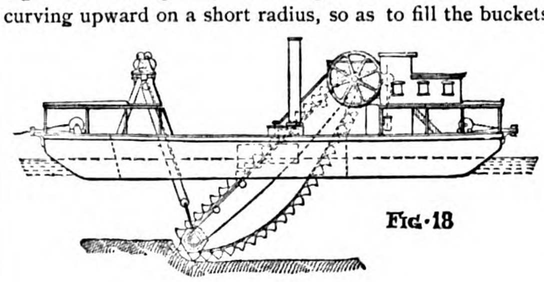


FIG. 18

FIG. 19

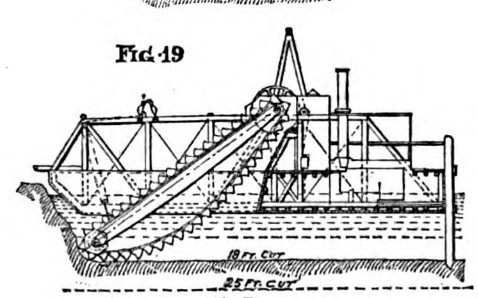
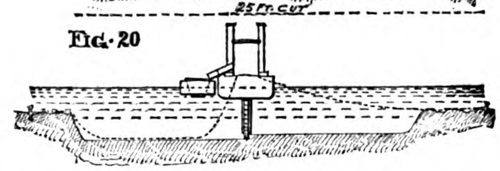


FIG. 20



The entire apparatus is in equilibrium as to the weight of the working parts, power being required to elevate the dredged material only, and to overcome the digging and frictional resistances. In regard to the expenditure of power, it appears from indicator cards taken by the writer from the engines of several machines, that about 226,000 to 353,000 foot-pounds of work is required per cubic yard of material actually discharged when in effective work. This of course depends on the depth from which the material is dredged, and its hardness.

It thus appears that the chain-bucket is good in principle, and also good in practice, as its extensive use testifies.

The structural details of the endless-chain machine have, as the result of experience, been gradually crystallized into something like a system, varied of course to suit different requirements.

In considering the details of this system the construction of the chain of buckets claims first attention. It is of obvious importance to keep their weight at a minimum while retaining the required strength. With many forms of chain, the tension caused by its own weight constitutes so large a proportion of the total working stress, that only a small balance is available for doing the work. The degree to which strength and lightness can be combined depends first, on the tensile strength of the metal employed, and then upon a skillful distribution of that metal. In the earlier forms, many examples of which are still in use, the endless chain consists of a series of stout wrought-iron links connected by joint-pins, the shell or body of a bucket being riveted to every alternate set of links. There are usually four links under and forming part of a bucket, and two intermediate connecting links, the eyes of which are bushed with steel. Such a bucket and one of the links are shown in Figs. 8, 9, and 10, which are drawn from actual measurement, and may be taken as a fair example of an extensively used bucket. A chain of buckets constructed in this manner will do good and rapid work in moderately yielding material, while they can be kept at it; but the wear is excessive on account of the small and roughly fitted bearing surfaces of the joints, and the grinding action of sand and water. There being very little stiffness to this kind of bucket the springing of the plates and hard knocks tend to loosen the rivets, and about six months' work suffices to get the bucket ready for the repair shop.

Official returns of the performance of an extensive dredging plant in another locality shows, by a statement of repairs, the average life of a bucket of the kind described above to be 146 days, of a connecting link 77½ days, and of a joint-pin 102 days, these being the average intervals of service before requiring removal for repairs. They will, of course, stand a limited number of such repairs before becoming finally useless.

With the recent development of the art of making sound and tough steel castings, new possibilities were opened up, and the four links of a bucket are now made in a connected form of a single steel casting, to which the top or body is riveted. A bucket of this kind is shown in Figs. 11 and 12. The construction is thus greatly simplified and much of the difficulty caused by the shaking loose of a number of riveted parts is obviated.

More recently still it has been shown that the entire bucket can be advantageously formed of a single steel casting. There still remained, however, the destructive and costly wear of the bushes, pins, and links, used in connecting the buckets. Increasing the bearing surfaces and improving the standard of workmanship does not remedy the evil, as the amount of metal worn away with a sand and water lubricant is nearly the same; but being distributed over a larger surface, takes a little longer time, and it did not seem to pay to put good work on joints which would not stay good.

In Figs. 13 to 17 is shown a bucket of somewhat different design, but which follows out still further the direction indicated by the previous example. In this bucket the endeavor is made to combine the elements of lightness, strength, capacity, and durability to a degree not heretofore reached. Durability of the pin-connections is obtained by providing large wearing surfaces from which the sand and grit is excluded by a special form of self-expanding packing-ring. These wearing surfaces are then lubricated by positive feed from a grease-chamber formed in the bore of the tubular joint-pin, and which is arranged to be readily charged from the outside.

The bucket is composed of cast steel in one piece, with renewable steel cutting edges and wearing surfaces, and so proportioned that the safe working strength is in excess of the maximum tension that can be applied, so that the body of the bucket is practically indestructible.

It will be seen on reference to Fig. 13, in which several buckets embodying these features are shown in position upon the upper or driving tumbler, that they differ from all others both in general form and in the fact that no intermediate links are employed to connect them, as they are coupled directly to each other. They are adapted to work on an improved driving tumbler, in which the rear end of the bucket is supported by projections, forming an extension of the driving face of the tumbler. The links of the chain in passing over the tumbler, as commonly made in the form of a simple polygon, were subjected to severe bending strains, caused by the eyes of the links overhanging the corner of the tumbler. The links thus required to be made of greater weight and strength than was necessary to withstand mere tension. Considerable wear also occurred

* Abstract of a paper read at the fourteenth meeting of the American Society of Mechanical Engineers, December, 1886, by A. Wells Robinson, of Montreal, Can.

between the tumbler faces and the links; the corners of the former becoming rounded and increasing the liability to breakage of the chain. With the improved tumbler, having an extended seat on which the bucket bears for its whole width and length, the bending stresses are reduced so that the principal stress is reduced to a simple tension of the chain. The form of the bucket also permits of an enormous tensile strain being provided for without unduly increasing the weight, as the whole back, sides and bottom of the bucket constitute a link of great strength, and excellent form to resist both tensile and bending stresses.

It is of the highest importance to reduce the number of parts as far as possible. There are few mechanical appliances which are exposed to as rough treatment as dredge-buckets, and the best way to prevent them shaking to pieces is to make them with no pieces to shake.

The writer believes there is a misapprehension of the capabilities of the elevator system, as it has been successfully demonstrated that "hard pan," slate, shale, or other schistose rock can be economically dredged from its natural bed with a properly adapted chain-bucket machine. In dredging of this nature, the principal work of the buckets is to break up the material, and for this purpose they are made of great strenth and fitted with steel teeth of special form. The action thus resembles a series of powerful pick-axes delivering rapidly repeated blows. It will be seen that in work of this kind, a special advantage is derived from the doubling of the buckets—that is, constructing the chain wholly of buckets, instead of half the number connected by links—the digging effect being thus doubled.

Buckets for heavy dredging purposes, made entirely of cast steel, were first used in this country, to the writer's knowledge, about four years ago, upon the works with which he was connected. These have since been doing the severest kind of work, tearing up shale rock from its natural bed in 30 to 36 feet of water, and in a current of 4 to 6 miles per hour; and with the exception of some wear upon the renewable portions are practically as good to-day as at first.

There must inevitably be deterioration of the wearing surfaces of the buckets and connections, but while this is enormous with the older forms and appreciably reduced in the steel buckets referred to by a judicious increase of bearing surface, it can only be minimized by keeping the abrading substance out of the joints, and supplying lubricant, as is done in the improved buckets shown as 14 to 17, designed by the writer.

For the purpose of comparing the three forms of bucket which have been illustrated, the following table of proportions and capacity is appended:

	No. 1.	No. 2.	No. 3.
Maximum depth to which buckets can work, ft.	30	31	30
Number of buckets in chain	40	34	46
Capacity of each bucket ... cu. ft.	12	15	10.4
Pitch of each bucket ... ins.	30	30	39
Weight of bucket-chain per foot run ... lbs.	480	623	440
Weight of bucket-chain per foot of capacity ... lbs.	200	208	138
Total weight of chain ... tons	43	47	29
Safe working tension of chain ... tons	47	50	45
Wearing surface of pin-joints ... sq. ins.	31.5	42	75
Max. pressure on pin-joints ... lbs. per sq. in.	3,340	2,660	1,340
Ordinary speed of buckets ... ft. per min.	60	70	130
Discharging capacity ... cu. ft. per min.	144	200	416
Discharging capacity, cubic yards per day of ten hours	3,200	4,400	9,200

Numbers 1 and 2 being examples from British practice, it may be of interest to give some further particulars respecting the vessels and their performance.

The vessel referred to as No. 1 is 161 feet long, 29 feet beam, and 10 feet depth of hold; and is fitted with the wrought-iron buckets shown in Figs. 8 to 10. In one season of 2,694 working hours, this machine dredged 323,760 cubic yards at a cost of \$9,987, or $3\frac{8}{100}$ cents per cubic yard.

The second vessel is 130 feet long, 32 feet beam, and 10 feet 6 inches depth of hold. In the first six months' work this machine dredged 409,500 cubic yards in 139 working days, at a cost of \$9,309, or $2\frac{27}{100}$ cents per cubic yard. The material was mud and clay, with some gravel and limestone marl, with a considerable number of snags and roots, and the cost includes wages, fuel, stores, repairs, and maintenance, but not towing or depositing the material dredged.

It will be seen from the table that the weight of the bucket-chain in column No. 3 (as illustrated in Figs. 14 to 17), while of equal strength, is considerably less per foot than No. 1 or No. 2. The increase of capacity and larger wearing surfaces should also be noted, together with the fact that a reduced pressure per square inch is obtained in protected and lubricated joint connections, instead of a heavy pressure in a joint exposed to the grinding action of sand and water.

With the improved buckets and simplified construction, the chain-bucket machine is capable of still higher results than those stated above, as much of the difficulty labored under from excessive weight and wear and tear is done away with, and a machine produced which is cheaper in first cost, because the weight is less, and cheaper to maintain, because more durable.

Figure 18 shows a type of machine adapted for channel work, and represents a dredge having a capacity of 6,000 cubic yards per day, and capable of dredging to a depth of 25 feet. The mode of working is shown in Fig. 20. The hull is moored in position by anchor chains controlled by a steam-winch, and the buckets feed sideways over the bottom for the width of the channel to be made, advancing a short distance ahead at every cut by hauling in on the bow-chain. In some cases a spud anchor-post is used at the stern for mooring the hull, the buckets at the front end taking a radial cut about the spud as a centre. A machine of this kind is represented in Fig. 19.

In considering the cost of excavating machines regard should be had not only to the first cost, but to the cost of maintenance in relation to the capacity, and to the extent and duration of the work to be done. Where the work is such that the machines can be kept employed without great or frequent periods of idleness, the first cost becomes a very small factor in the total cost of doing the work.

In many cases concentration of plant is desirable, as reducing the working and other expenses. This tendency is illustrated by the fact that a large proportion of British machines are now built as "hopper dredgers"—that is, a combined self-propelling dredge and scow—so that one vessel constitutes the complete plant. These vessels can dredge a load of 800 to 1,000 tons in a few hours, and then steam off at at eight or nine miles per hour and dump it.

In view of the national and public works in which dredging and excavating form a considerable part, it is of importance that the subject should be more fully understood, and the fact appreciated, that the cost of such work is largely governed by the efficiency of the plant employed.

The buckets shown in Figs. 13 to 17 have been patented by the author of the paper.

In our next issue we hope to present some recent improvements in dumping-scows.

(TO BE CONTINUED.)

THE MEMPHIS WATER-SUPPLY.

THE citizens of Memphis, Tenn., are soon to be called upon to determine whether their water-supply shall be controlled by their own officers or shall remain under the control of a private corporation. The city has been supplied with water for about fourteen years by a company which does not appear to have rendered altogether satisfactory service, for on July 23, 1885, the Legislative Council appointed a committee of ten citizens to "consider all matters appertaining to obtaining a bountiful supply of pure, clear, and wholesome water for the use of the entire district; to take into consideration the purchase of the present water company's plant, or the establishment of new water-works entirely; to consider the source whence this water is to be obtained and the probable cost of the same, the building of reservoirs, and the probable cost of keeping the same in a pure and healthy condition, and the erection of stand-pipes, * * * the manner in which the financial matters shall be arranged, and the proper legislation to be obtained to carry out and consummate their views."

This committee entered upon the discharge of the comprehensive duties entrusted to them by a consideration of the question of whether it was better to have the city own the works or to have them owned by a private corporation. After long and careful discussion, they unanimously voted that it was better that the works should be constructed, owned, and operated by the city.

To General Colton Greene, a member of the committee, the special investigation of the best sources and modes of supply was deputed, and from the reports which he has presented, one on February 23 and the final one on December 1, 1886, it is evident that he prosecuted his work with great thoroughness, caution, and intelligence.

The quality of the water being of the first importance, General Greene had samples of all the waters which it was possible to use for a public supply examined by Dr. Charles Smart, U. S. A., analyst to the National Board of Health.

After more than six months' study of all possible sources and modes of supply, General Greene and the committee decided that the project which promised the best results was that of taking the supply from Wolf River, forty-five miles above its mouth, and pumping the water nine miles to a reservoir near the city. The success of this scheme depended on the approval of the analyst, of the Wolf River water at the point of intake, and on the approval of engineers of the plant proposed for pumping and clarifying the water, which at certain stages is turbid to a degree considered remarkable in even a Mississippi Valley stream. General Greene's examinations had led him to believe that entire clarification could be effected by the Hyatt process of filtration and aeration. To be perfectly sure on this point, samples of the river-water, collected when the stream was at almost its worst condition, were submitted to Dr. Smart for analysis.

The opinion of Mr. A. A. Willson, M. E., of the Quintard Iron Works, New York City, was requested as to the mechanical features of the filtering plant proposed by the Newark Filtering Company, and Mr. J. J. R. Croes, M. Am. Soc. C. E., was called on to examine into the feasibility of purifying the water by the method and at the rate guaranteed by that company to be effected for a fixed sum named by them.

The reports of these three experts were duly presented to General Greene, and the conclusions he drew from them were favorable to the project he had designed, and he so reported to the committee on December 1. His colleagues unanimously concurred in his views, and have presented a report to that effect to the Legislative Council, recommending the passage of a law by the Legislature authorizing the government of the taxing district to build and operate water-works on the plan recommended by General Greene.

This plan is, to take the water from Wolf River about twelve miles from the city, and pump it nine miles to a reservoir on high ground. Before entering the reservoir, the water to be filtered and then aerated.

Near the reservoir a high-service pump and a water-tower to be built, to enable greater pressure to be furnished to a part of the city and fire-pressure to all parts if needed.

Dr. Smart's report is very voluminous, but the conclusion arrived at is that "the water of Wolf River, though extremely unsightly and repulsive in its turbid state, is an excellent water when its suspended matters have been removed." "There are no facts before the writer to warrant him in forming an opinion on the ability of the Hyatt filter to accomplish its proposed work; but if the filtration be effected and a clear water furnished, that clear water will be of a satisfactory quality for all the purposes of a municipal supply."

Mr. Willson's report considers in detail the mechanical devices used in the filtering and aerating process, commends the ingenuity of the arrangements, and caculates the additional cost of pumping due to the interposition of the filter between the pumps and the reservoir. His conclusion is that "the general design and arrangement of the details of the proposed filter-plant are excellent, and I can see no reason why, in a mechanical point of view, the whole plant should not operate practically as it is contemplated it will." "Considering the limited demonstration the Filter Company have only been able to make of the practical working of this filter, it is impossible for the engineer to predict with certainty its success or its failure, when adopted for works of as large capacity as those proposed for Memphis."

Mr. Croes's report is to the effect that after examination of the proposed plant he is of the opinion that the practicability of the filtration of water at the rate of 150 gallons per hour per square foot of filter-suface, by the use of Hyatt's plan of introducing a small quantity of a coagulant into the water just before its passage on to the filter-bed, is fully proven, but that the plant described in the company's proposal is not capable of doing the work they agree to do. He considers that the method of aeration proposed will be of great benefit to the water, but probably not to the extent claimed by the inventor; and that the cost of operation will be in excess of the designer's estimates. But even with these exceptions he concludes that "the general plan of filtration proposed is entirely practicable and will be economical." "The particular plant described in the specifications I consider insufficient to accomplish the desired end, only in respect to the head of water provided for on the filter-beds, which should be greatly increased."

The fact that Memphis was known to be looking out for a better supply has excited considerable interest among the various contracting firms in the water-works business, and one of them has purchased control of the old Memphis Water Company and has made a proposition to the Legislative Council to furnish a new supply of water to the city for an annual subsidy of $30,000. The water to be taken from Wolf River and to be settled in basins before being pumped into the mains.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

THE HEATING AND VENTILATING ARRANGEMENTS OF THE VIENNA ORPHEUM.*

[*Translated for* THE SANITARY ENGINEER.]

THE arrangements here described were adopted in obedience to a municipal ordinance of July 1, 1882, requiring a supply of fresh air of thirty cubic metres per hour and person.

The theatre in question allows smoking. Mechanical apparatus for ventilation was not to form a part of the plan. The atmosphere of the auditorium is described as quite intolerable, even before the beginning of the performances; being so cloudy that nothing could be seen from the rear and galleries, and the oxyhydrogen light worked from the second gallery had a comparatively feeble effect. The heating apparatus consumed from eight to ten hundredweight of coal daily without marked effect.

On examination, the structure seemed unsuitable for ordinary schemes of ventilation, as the auditorium is built of masonry (0.64 of a metre thick) only to half its height, above that being of light timber-work, the long side walls of which consist of windows; while the roof has no proper attic story, but consists of a thin sheathing.

The hot-air chamber was small, and nearly filled with apparatus of indescribable form, so as almost to prevent a through draught. The hot air was conveyed through long horizontal pipes (broken), discharging by four tubes of 30 centimetres diameter (12 inches). The entire ventilation apparatus consisted of four pairs of wooden slat-shutters on the four sides of the monitor roof. No provision for introducing fresh air was made.

The plan proposed by the author, and carried out, included heating arrangements for the auditorium entirely separate from and independent of those for the stage and dressing-rooms. The aspiration system was adopted,

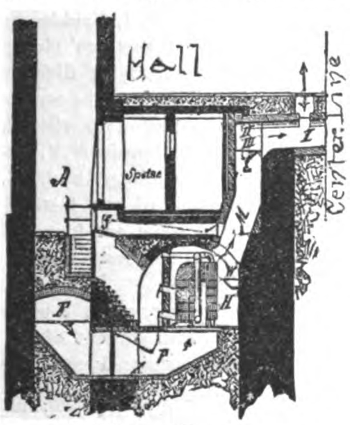


FIG. 3.

arranged both for summer and winter use; also arranged for circulation of heat without ventilation previous to performances.

AUDITORIUM.

The calculation allowed for a maximum audience of 1,000, the usual number being between 700 and 800. This requires an hourly change of 30,000 cubic metres of air. For 40 gas-jets in the foyer and galleries (reckoned at three persons each) 3,600 metres were allowed, making a total of 33,600 c. m. per hour, equivalent to a renewal of the entire air six and a half times in an hour. In this estimate no allowance was made for the air entering by windows, doors, and various surfaces, though in this building they should play an important part; such air was considered as extra, and was only taken into account in arranging the outlets and estimating the heat required.

* A paper read by Joseph Leschetizky, engineer.

Fresh air is taken from a large garden belonging to the estate of Count Clam-Gallas, where a thick growth of trees kept the air perfectly pure and fresh. From a point three metres above the ground it is led by a canal, F, 17 m. long and 3.2 m.^{2} in section, built under the level of the yard and descending to a depth of 12 metres under the heating-chamber H, the bottom of which is 9.8 m. below the floor of the auditorium.

The heating-chamber has the capacity of 33.5 m.^{3}, and is connected by a vertical funnel M with the distributing canals I. II. III. IV. above. This rising funnel M also

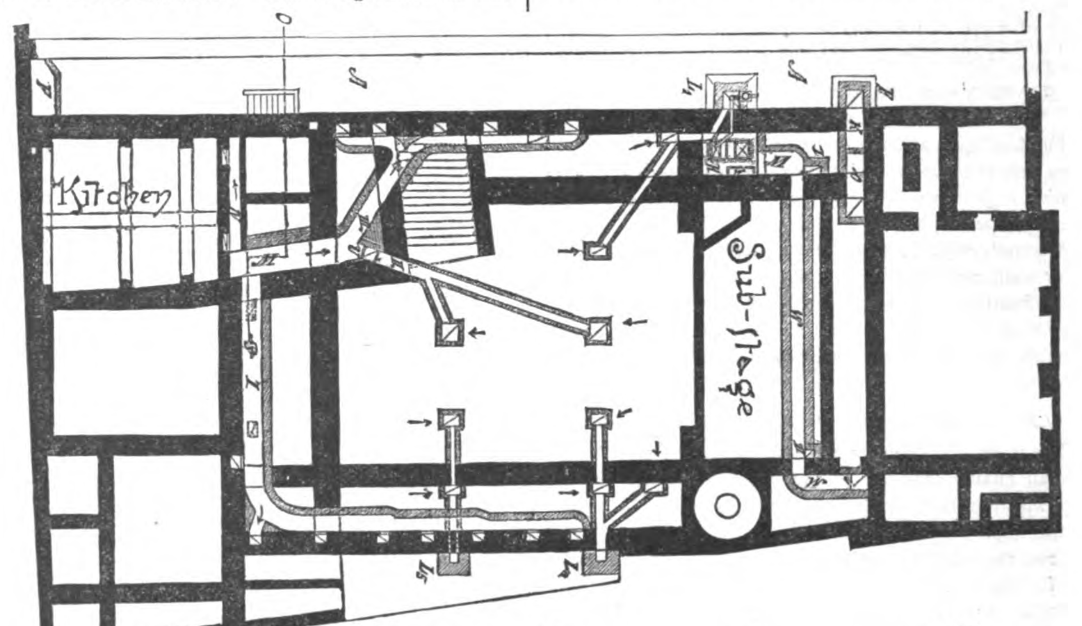


FIG. I. CELLAR AND FOUNDATION PLAN.

serves as a mixing-chamber, to which end it is entered by a canal *f* (Fig. 3) with a section of 0.78 m.^{2}, communicating with the outer air.

The heating-chamber contains two large heaters, with a simple tube system of tin, and which together have a heating surface of 54 m.^{2}. The heated currents pass over a reservoir containing 864 litres of water, with evaporating surface of 1.2 m.^{2}.

From the mixing-chambers the canals separate in different directions—viz.:

Canal I., to the right straight through the hall to the right side wall, 0.8x1.2 m.; Canal II., toward the centre of

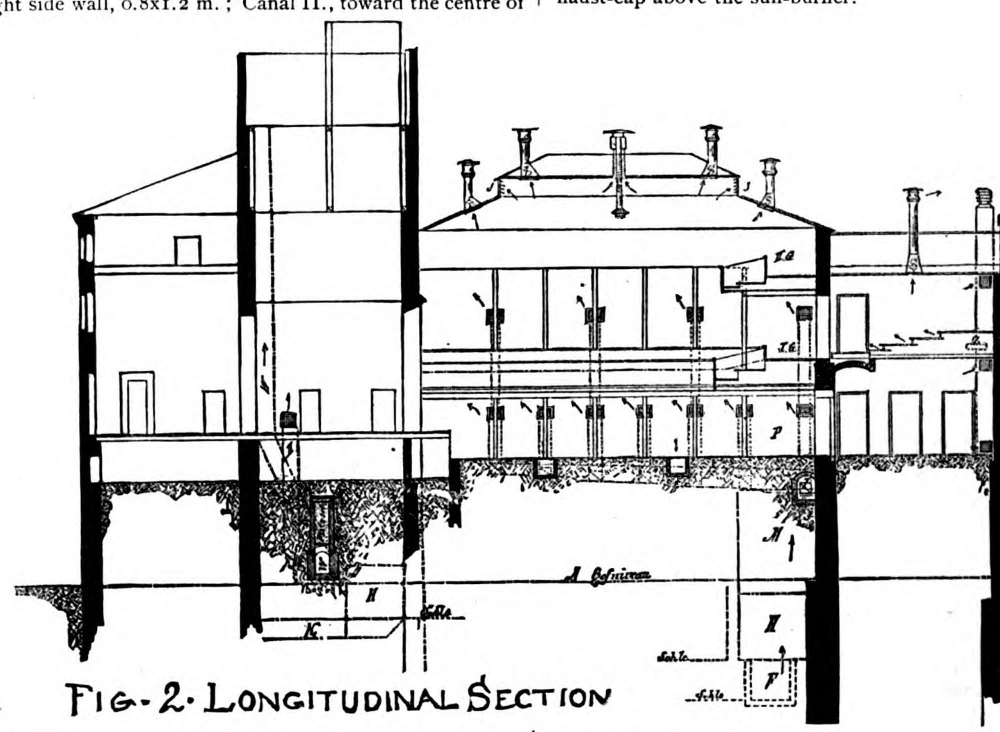


FIG. 2. LONGITUDINAL SECTION

the hall 0.6x0.8 m., with a branch; Canal III., toward the left side of the hall, 0.8x1.0 m., where it divides with a Y; Canal IV. (a canal formerly existing), toward the left of the rear wall of the hall, 0.4x0.6 m. The canals contract in an ascending direction toward their ends and have vertical branches to the openings in the hall. Canal II. (for the purpose of circulation-heating) is placed in direct connection with the air-box under the heating-chamber, and is therefore provided with a special register, U. The same canals serve also for the introduction of fresh air in summer.

Canal I. has	2 openings	0.4x0.8 in the floor.
	8 "	0.4x0.6 in the side wall 2 m. high.
	5 "	0.4x0.6 side wall of gallery 2 m. high.
Canal II. has	2 "	0.8x0.8 in the floor.
Canal III. has	1 "	0.4x1.2 " "
	5 "	0.4x0.6 in the side wall 2 m. high.
	4 "	0.4x0.6 side wall of gallery 2 m. high.
Canal IV. has	2 "	0.4x0.6 in the wall.

The air is extracted (*a*) by draught-chimneys acting on foul-air ducts under the floor; (*b*) by special suction apparatus in the ceiling; (*c*) by partial use of the wooden shutters in the roof. These are described separately:

(*a*) Five shafts. L, in the yard, 25 m. high, 0.75 m. square, carries smoke-pipe from large stage-stove; also contains stove for summer ventilation; draws from floor of parterre and gallery. L_2 and L_3 in spaces near the foyer, 12 m. high, ½ m. square, with large stoves, draw from foyer and gallery. L_4 and L_5, 9 m. high, 0.45 m. square, have special heaters with Bunsen burners, and draw from parterre floor and side walls of gallery.

(*b*) Consists of six pieces of apparatus, with channel 0.6x0.8 m., covered with Wolpert's caps, 30 c. m. in diameter, in ceiling; with pipe 30 c. m. diameter and exhaust-cap above the sun-burner.

For additional supply of air in summer there are various additional openings and valves. If there is a great crowd on a hot day, the large ventilating-valve over the stage can be raised between the acts, the iron curtain being dropped; the effect of which is to produce a rapid cooling.

All valves are regulated at will, and are furnished with strong cast-iron gratings and the prescribed wire nets.

All the openings of the inlets are two metres above the floor, and are provided with conical mouths, of peculiar shape, to regulate the rate of discharge and balance the obstruction caused by gratings. The movable slats in front of them direct the current upwards.

CALCULATED SUPPLY OF AIR.

The average outside temperature being —3° C., that inside being 16° C. in the parterre and 18° in the second gallery, while the air discharged is at 28° C., it is calculated in the usual way by Péclet's formula that the air introduced per hour through 29 openings in the parterre and side gallery equals 34,966 cubic metres per hour. The added supply in summer is 10,310. The five exhaust-shafts are calculated to draw from the lower part of the hall 15,286 metres; the double Venetian shutters in the raise of the roof 12,960, and other suction apparatus in the roof 7,556 m.; a total discharge of 20,516 upwards, and 35,802 altogether. Added summer supply, 16,140.

HEATING AND VENTILATION OF THE STAGE AND WARDROBES.

The footlights and the influx of air from the auditorium have here to be considered; the question is rather one of heating a given space by applying heat at given points than of supply per capita.

A supply-pipe F, three metres high, was fixed to the outer wall, and extended as a duct K (0.65x2.20 m.) down to the heating-chamber, six metres below the stage floor. Into K also opens the duct C, destined to bring air down from the stage when complete renewal by fresh air is not required.

CELLAR AND FOUNDATION OF THE ORPHEUM.

The warm air is conducted from the heating chamber by a small mixing-chamber M, connected by a short vertical pipe with the fresh-air duct K, to temper the heat of the air distributed.

From the mixing-chamber rises a vertical duct I (0.4x0.4 m.) for the left stage and two wardrobes; also the duct W (0.6x0.8 m.) crossing below the stage for the supply of the right side and dressing-rooms. The five rooms on the right use the existing flues partly for supply of air, partly to discharge it; those on the left discharge into the large chimney L. The stage has two discharge-orifices (0.4x0.6 m.) and a ventilator (0.4x0.6), besides an opening for circulation without change of air (0.8x0.8).

There are three large stoves of the self-feeding sort, burning coke. With the stoves for the chimneys, these consume daily 2½-hundredweight of coke. When in full action they burn equally for 10 hours, they are lighted daily two hours before the performances, and remain untouched.

In winter, after lighting fires, the orifices of discharge are closed, and the valves set to secure circulation of hot air; for half an hour all the hot-air registers, except those at the farthest ends of each duct, are shut, which warms the ducts sufficiently, and afterwards the circulation of heat goes on, till the house stands at 16° (=61°F.). Shortly before opening the house, the valves for discharging foul air are opened, since the house fills very quickly.

The system has been tested for two seasons, and has given a uniform temperature without perceptible draught; the air is as free from smoke at the end as at the commencement. The lessee has been enabled, in consequence, to change the second gallery to family boxes, which are favorite places, whereas it formerly always stood empty.

The successful working of the system is largely ascribed to the introduction of self-feeding stoves in the aspiration chimneys, which insures regularity and enables us to dispense with attendance.

OBSERVATIONS ON BOILER EFFICIENCY FOR VARIOUS CONDITIONS.

THE charts of efficiencies and description given below were prepared by Mr. John A. Caldwell, of New York, from the results of his own experiments on steam-boilers.

The chart of lines submitted may be described as follows: The ordinates from one to thirty represent thirty tests for evaporation of water from as many water-tube boilers, the test being made at different places, times, and by different engineers. The position of the cross lines on any given ordinate indicate amounts as follows:

Line A, the number of pounds of water evaporated from and at 212° per pound of combustible burned on the grate, each vertical space measuring for line A=2 pounds.

Line B, the pounds of combustible burned per hour per square foot of grate-surface, each vertical space measuring =2 pounds for line B.

Line C, the pounds of combustible burned per hour per 10 square feet of heating-surface, each vertical space representing only one pound in the case of line C.

Line D, the ratio of heating to grate suface, each vertical space representing 10 square feet for line D.

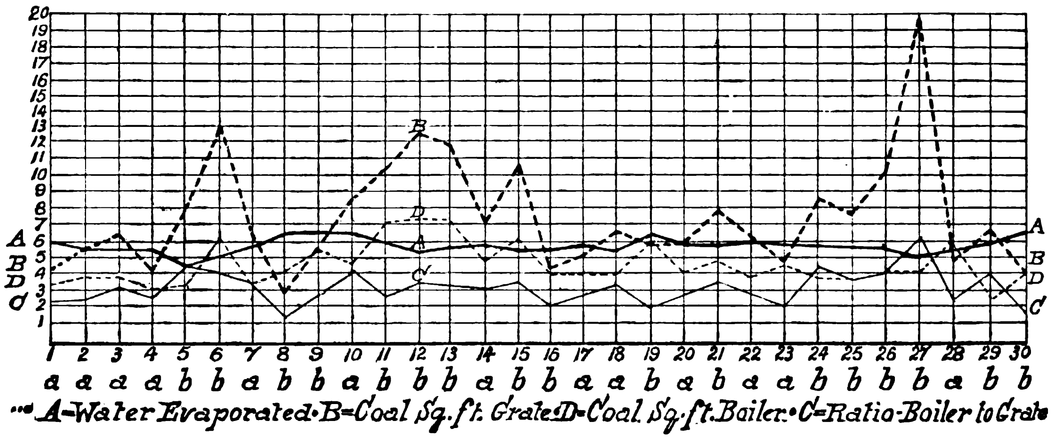
The lines, although measurably correct, are meant to show proportions V rather than definite amounts.

The letters *a* and *b* at the foot of each line tell the kind of fuel used during the test, *a* standing for anthracite and *b* for bituminous coal.

For example, on test No. 12 the ratio of heating to grate surface was 73 of heating to 1 of grate. The pounds of combustible burned per hour per square foot of heating-surface was .34 of a pound. The pounds of combustible burned per hour per square foot of grate surface was 25, and the pounds of water evaporated was nearly 10½ per cent.

The lines show, with startling clearness, that a given proportion or ratio of heating to grate-surface will not by itself result in a certain definite measure of evaporation of the water in the boiler.

It will be noticed that line B goes up quite high at ordinates 6, 12, 15, and 27, indicating a strong fire during the particular tests that those ordinates stand for, but it will also be noticed by inspecting line A, at those same ordinates, that the strong firing had not the effect of producing a high evaporation, but rather the opposite. On the other hand, when line B falls, at as 8 and 30, the line A shows to good advantage, indicating as high as 12.49 and



12.62 pounds of water evaporated per pound of combustible.

Ordinates 9, 10, and 19 also show high evaporation without the necessity of line B being low; this is particularly the case at 10 and 19. Briefly, a slow fire at 8 gives high evaporation, while a strong fire at 10 gives a trifle better result.

At the points of highest result on line A—viz., 1, 8, 9, 10, and 30—all the other lines occupy lower places on the ordinates, with the exception of 10; this would seem to show that a medium fire, with medium or low ratio of heating to grate area—say 30 to 1—was good practice. On the other hand, the fact that the lines cross and recross each other, no two lines rising and falling uniformly, shows that it is quite difficult to predict what the results will be from any given furnace or boiler. Suggesting that the draught, the firing, the degree of dryness of the steam all play a considerable part in the result and evaporation, I submit the above chart in hope that it may lead to a discussion among your readers as to the proper proportion of grate-area to heating-surface in a water-tube boiler, also different modes of firing, etc.

PUBLIC WATER-CLOSETS IN LONDON.

(From our Special Correspondent.)

THE Commissioners of Sewers of the City of London and their engineer, Colonel Haywood, are to be congratulated on the steps they are taking to provide decent and proper accommodation in the city in the shape of closets, urinals, etc. To within the last eighteen months the only public conveniences (with, I believe, two exceptions) were the ordinary iron stall-urinals. The exceptions were two small buildings in Bishopsgate and Ludgate Circus, containing trough-urinals (vitrified pipe) and one closet. The stench from the urinals, notwithstanding automatic flushing, was always offensive, while the closets were chiefly used by errand-boys and the lowest classes, and not therefore available for the general public. In addition to these buildings the Châlet Company possess some two or three stations, where convenience was obtainable at a charge of 1*d*. (2 cents). Beyond this there was absolutely no convenience. About eighteen months ago the Commissioners constructed an underground urinal, with closets, opposite the Mansion House and Bank of England, and this has lately been followed by the construction of two more such buildings in King William Street and Farringdon Street. These places are excavated below the pavement-level, height from floor to pavement being 10 feet. Entrance to the structure is by stone steps, surmounted by railings and gates for closing at night, so that the only indication of their presence is these railings. Lighting is effected by pavement lights for day and gas by night, the ventilation through gratings afforded by day being supplemented by ventilating-shafts formed by the standards of large street-lamps placed on the refuges under which the urinals are constructed. The fitting up of all the structures is similar. The walls are of glazed brick, floors generally asphalt, floors under closets Portland cement, under urinals slate dished, and with a brass grating and gulley and trap under each stand. There are Jennings' lip-urinals, and the water-closets, risers, and seats are hinged and provided with a lock and key for inspection and cleansing purposes. The urinal-pans and floors are flushed automatically every two or three minutes. Attendants are provided who cleanse the place, keep the closets clean, etc., and charge 1*d*. (2 cents) for each person using a closet. The urinals are free. The Mansion House structure is elliptical, 38'4"x 33'8", and is constructed out of the solid concrete forming the base of pedestal for a statue standing over it. It contains 12 closets and 20 urinals, also two attendants' rooms. The structures at King William and Farringdon Streets are 25'6"x16' and 43'8"x14', and contain 4 closets and 9 urinals and 5 closets and 9 urinals respectively, besides one attendant's room. All metal-work in the urinals is brass.

PLUMBING-WORK AT THE HUDSON RIVER STATE HOSPITAL, POUGHKEEPSIE, N. Y.

WE are indebted to Mr. P. H. J. Krulder, Superintendent of Construction of Vassar Brothers' Hospital, Poughkeepsie, N. Y., for the accompanying illustration of the drainage system in this building and the explanatory data:

Some time ago I had occasion to visit the Hudson River State Hospital at Poughkeepsie, N.Y., and believing the system of plumbing-work arranged by Dr. J. M. Cleveland, M. D., Superintendent of said institution, was of much interest, I inspected some and found no sewer-gas penetrating the building, as the best care had been given to exclude this dangerous gas.

The hereby annexed drawing, which I made according to my own measurements with consent of Dr. Cleveland, shows the arrangement of waste and ventilating pipes and the construction of traps.

All waste and ventilating pipes are carried in a warmed ventilated brick shaft some feet above the ridge of roof, and by the use of automatic flush-tanks emptying every 3 or 4 minutes, a constant flow of water is carried through the waste-pipes, displacing the air in the ventilating-pipes, forcing same out above the ridge of roof, diluting and destroying its poisonous effects by coming in contact with the free air.

A constant pumping, so to speak, is kept up day and night, making all closets, basins, urinals, etc., smell sweet and pure.

The receptacle A B is built of brick laid in Portland cement. The floor of same is of bluestone flags; the top and diaphragms are also of rubbed bluestone, all well laid in Portland cement. The stone cover is pierced with holes to receive the waste and ventilating pipes, and all made air-tight so that no gas or foul air can escape through any opening between pipes or stones. At B enters the blow-off pipe of hot-water boiler, for flushing above said receptacle A B when required, and is controlled by a steam-valve.

The stone diaphragms of traps in A B, near centre of receptacle, secure a constant water-seal between sewer and pipes.

The waste-pipes of each set of waste and anti-syphon pipes are provided with a running-trap and ventilating-pipe to give additional security against sewer-gas entering through fixtures. There are three running-traps for each of the three stories of the building, arranged as shown on drawing. A front air-vent is given exclusively to each running-trap.

The hoppers and urinals are Wedgewood earthenware, and all iron pipes and fittings used in this work are of extra heavy cast iron, coated with tar preservative solution.

Dr. J. M. Cleveland is Superintendent.

Correspondence.

TO WELD STEEL TO IRON OR STEEL.

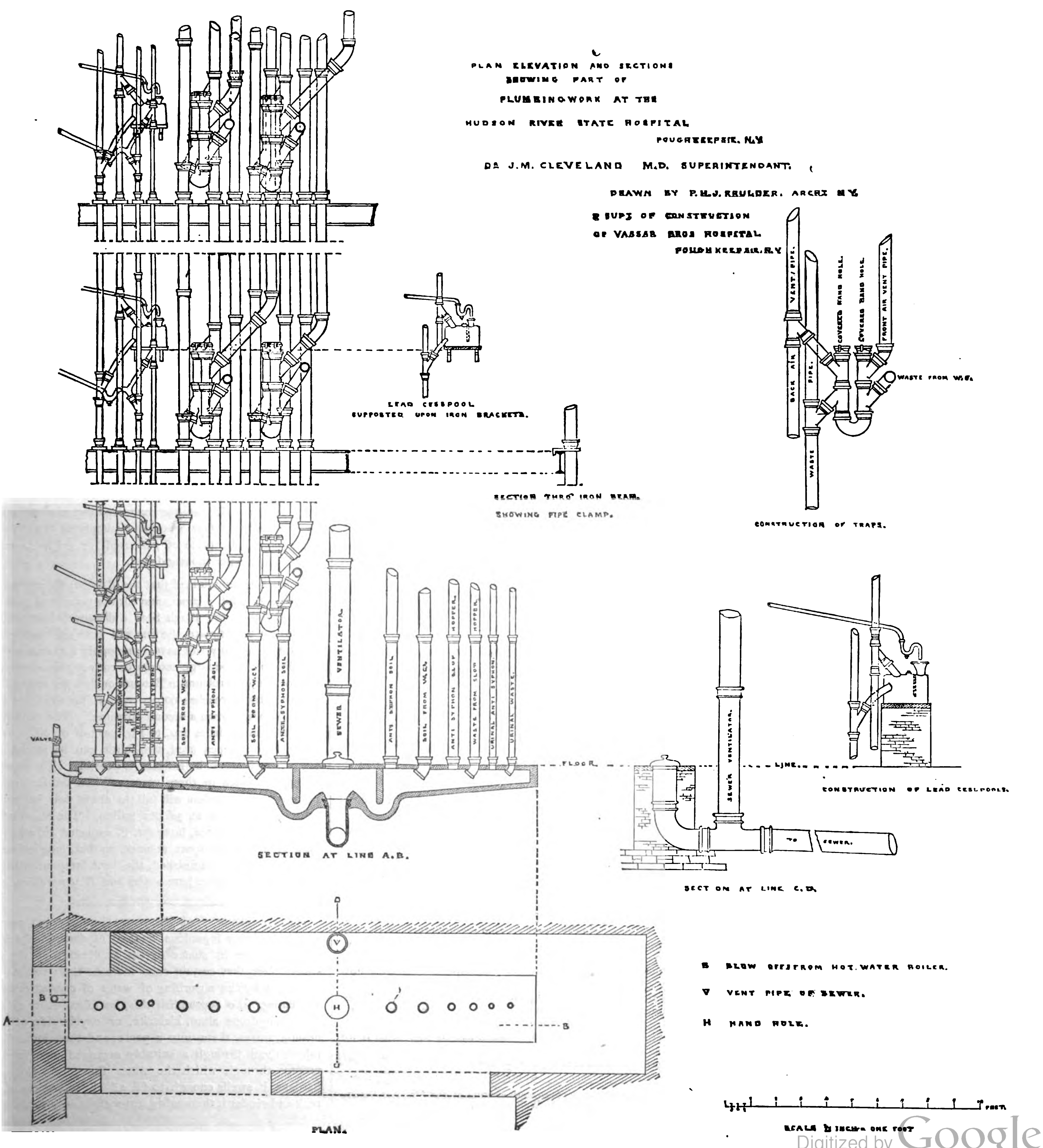
UNDER this title a recipe is published (in *Engineering News* of November 27), being copied from *Le Genie Civil.* The important point to be noticed is the use of *iron filings* as a constituent part of the mixture.

Some years since, when acting on one of the committees of award at the American Institute Fair, a similar compound was presented for our examination.

As the writer could not see the propriety of introducing a metal of lower strength, such as iron filings, as a foreign substance between the faces to be welded, a test was proposed. Several pieces of steel of about 90,000 pounds tensile strength were welded by the use of the mixture and fitted for test in Thurston's machine. Some of the same steel was welded by an expert blacksmith in the ordinary way. The *latter* gave the full tensile strength of the steel, while the former broke in every instance largely along the welded surfaces, and gave a strength, as was expected, about equal to that of good wrought iron. The matter is of so much importance that it seems desirable to make this statement, so that the new method (if it *be* new) may not be adopted without a thorough examination of its merits. In the case mentioned it was evident to all except those who were prejudiced that the test pieces were *soldered*, rather than *welded*.

The test in Thurston's machine being one of *torsion* was particularly well adapted to show the fallacy of this method of welding. F. COLLINGWOOD.

New York, December 6.



REVERSE OF CIRCULATION BETWEEN BOILER AND WATER-BACK.

ROCKLAND, ME., December 11, 1886.

SIR: I would like to ask you a question in regard to hot-water circulation. I was called to look at a boiler and I found that the water would come hot to the side coupling. The cold water in the boiler would drive through the hot-water pipe to the stove with a gurgling noise. Cannot account for it; everything about the boiler seems to be all right—in fact I put in a new boiler. Would you kindly give it space in your columns? The boiler is in the bath-room on second floor, the tank about two feet above the top of boiler. The expansion-pipe is one foot above top of tank. Respectfully, A. S.

[If our correspondent will send a diagram of the apparatus he alludes to above, we will endeavor to account for the cause of a reversed circulation, if one exists.

If the water comes hot to the side coupling, we cannot see how the cold water in the boiler can drive through the hot-water pipe to the stove, as they must be the same pipe and coupling. There is some mistake in the wording of the letter.]

APPARATUS FOR MAKING THE SMOKE TEST.

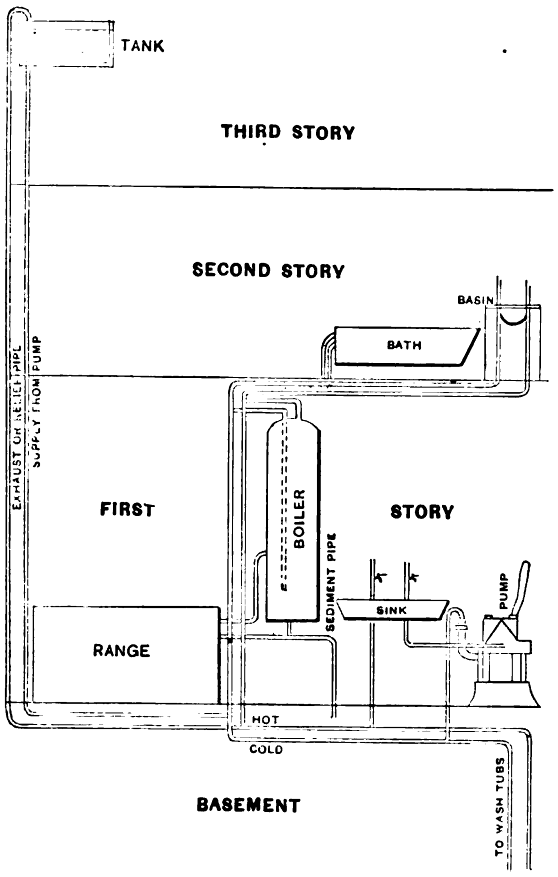
ST. PAUL, MINN., December 9, 1886.

SIR: Will you kindly inform me where I can obtain an apparatus for testing soil and waste pipes with smoke-pressure? Yours truly, J. T. HOLMES.

[Referred to our readers and the advertising columns issue of November 27.]

BOILER COLLAPSE.

SIR: Herewith I send you a sketch of a kitchen boiler that has collapsed twice. The first time it happened was when we had to draw water from the boiler at the sediment cock for repairs, the tank-supply being shut off, and again when we wanted to repair the pump. We pump the water to the tank by hand. At the time the boiler first collapsed



the faucets at the bath-tub and wash-bowl on second floor were open. Can you suggest the cause and give a remedy? Yours truly, A READER.

[The remedy would be in carrying the relief-pipe from the highest part of the hot-water pipe to the tank, instead of trapping it by running under floor of first story. The pipe will serve as an expansion-pipe as it is now, but not as an air or steam vent. The dotted lines show the proper way to run a vent. It must have no traps or dips in it. The direct cause, therefore, is the want of a proper vent. The cause of the collapse when the bath and basin cocks were open was probably that though the cocks were open enough to run water under pressure, the disks were loose enough on the stems to form check-valves under the pressure of the entering air. This may have been a contributory cause, but had the vent-pipe been in the right place the collapse would not have occurred, and a plumber when drawing off the water who opened these cocks performed all that could be reasonably expected of him to prevent a collapse.]

DANGER OF PASTING LABELS ON GLASS.

NEW YORK, December 6, 1886.

SIR: Referring to the letter of Andrews & Jaques, which appeared in THE SANITARY ENGINEER AND CONSTRUCTION RECORD of November 13 (page 571), I will say that I have experimented somewhat with a sample of the mucilage in question, but I have not been able to get stains which could not be readily removed.

I tried pasting labels on glass, and also smeared the mucilage alone over the glass, using such kinds of glass as I had at hand. After standing for a week or more the labels were readily removed with water, leaving a deposit on the glass, which, however, I scraped off easily with a knife. I also used a little sapolio without injury to the glass. The mucilage is colored of a reddish or rose tinge, and while it leaves a coating on the glass, I cannot discover that the surface of the glass has been acted upon chemically. L.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
December 18.. ...	25 66	20.71	20.33	29.55	29.95	23.10	31.81

E. G. LOVE, Ph.D., *Gas Examiner.*

IS WATER-GAS AN ECONOMICAL FUEL?*

IN the discussion of F. W. Taylor's paper on water-gas, at the Chicago meeting, the writer stated that the conclusion to which Mr. Taylor had been led by his experiments—viz., that water-gas is not as economical as Siemens gas, when used as a fuel for steel-melting furnaces—would probably be confirmed by a theoretical consideration of the amount of heat carried away in the chimney-gases. A further study of the subject shows that the opinion then given was correct.

Let C represent the carbon in a given quantity of fuel.
- O the oxygen needed to make carbonic oxide (CO) with this C.
- 2O the oxygen needed to make carbonic acid (CO_2) with the same C.
- H_2O the water needed to make water-gas of the formula (CO + 2H) with the same C.
- N the nitrogen in the air from which the O is taken to burn C to CO.
- 2N the nitrogen in the air from which the 2O is taken to burn C to CO_2.
- Ex. air the excess of air used in final combustion in the furnace over that required to make complete combustion.

The fuel may be used in three ways:
1st, By direct and complete combustion in the furnace.
2d, By partial combustion in the Siemens gas-producer, and final combustion of the Siemens gas in the furnace.
3d, By partial combustion in the water-gas producer, and final combustion of the water-gas.

The results of the three ways of burning the fuel are as follows:

		Materials used.	Products.
1.	Direct.	C+2O+2N+Ex. air	Co_2+2N+Ex. air.
2.	Siemens.	In producer, C + O + N	CO+N (Siemens gas).
		In furnace, CO+N +O + N + Ex.air.	CO_2 + 2N + Ex. air.
3.	Water-gas.	In producer, C + H_2O	CO+2H (Water-gas).
		In furnace, CO + 2 H + 2O + 2 N + Ex. air.	CO_2 + 2N + Ex. air + H_2O

The final product of (1) and (2) is the same. The final product of (3) differs from that of (1) and (2) only in containing H_2O, which is the same H_2O (water) which was added in the producer in making the gas. This is true whatever may be the actual formula of the water-gas. All the water originally used in the manufacture of the gas reappears in the products of combustion in the chimney. The only difference is that in the chimney it appears in the form of steam, superheated to the temperature of the chimney gases, while it originally enters the system as cold water. All the heat contained in the water thus escaping in the chimney, above the amount it contained when it was originally introduced into the system, is entirely wasted.

The amount of heat thus wasted can be calculated if we know the amount of water used, and its temperature on entering and on leaving the system.

Suppose a pure water-gas to be of the formula

CO + H made from C + H_2O
or, pounds, 12 + 16 + 2 12 + 18

The escaping gases would contain, in addition to nitrogen and excess of air,

CO_2 + H_2O
pounds 44 + 18.

The 18 pounds of water being the same from which the water-gas was made with 12 pounds carbon. The carbon if completely burned from C to CO_2 would generate 12 × 14,500 = 174,000 heat units (Fahrenheit). Suppose that the chimney gases are cooled by regenerators or other means down to 212° Fah., that the water escapes in the form of steam of that temperature—its total heat, including latent heat of evaporation being 1,178° Fah.—and that the water entered the system at 78° Fah. The heat carried away by this water escaping in the shape of steam, in excess of that which it introduced into the system, would be

1,100 × 18 = 19,800 heat units,

equal to about 11.4 per cent. of the whole amount of heat produced by burning the 12 pounds carbon from C to CO_2.

This is the most favorable case, for it is in practice never possible to cool the chimney gases of heating furnaces to as low a temperature as 212° Fah.

Theoretical considerations therefore indicate a loss of economy in the use of water-gas as fuel, equal to at least 11 per cent. of the total fuel value of the carbon used, and this, independent of any loss which may arise from imperfections of the producer or its method of operation.

Such a loss is not met with in the Siemens system, nor in the ordinary system of direct burning of the fuel upon a grate, except in so far as moisture in the shape of cold water may be present in the fuel used.

The fact that there is a loss of economy in the use of water gas as a fuel, in comparison with the direct use of the carbon from which it is made, is clearly revealed in other ways, however, even by some of those who have written in favor of the water-gas processes. For instance, Dr. Henry Wurtz, in Vol. VIII. Trans. Amer. Inst. Mining Engineers, pp. 295, 296, shows that 37.5 pounds of anthracite coal are required to generate 1,000 cubic feet of water-gas, and that water-gas has a heating power of 311° Fah. per cubic foot. This equals 311,000 heat units, per 1,000 cubic feet. Assuming anthracite to produce 13,000 heat units per pound (a moderate figure), the 37.5 pounds if burned directly would produce 13,000 × 37.5 = 487,500 heat units, showing that the water-gas has a thermic value of only 63.8 per cent. of the coal from which it is produced.

Better results are deduced theoretically by Mr. William A. Goodyear, Vol. XI. Trans. Amer. Inst. Mining Engineers, p. 311. He shows that water-gas derived from anthracite has about 81 per cent. of the heat-producing power of the carbon contained in the anthracite. Neither of the two writers named, however, seem to have considered the cause of the loss of heat to which I have referred—viz., the carrying away of heat in the superheated steam in the chimney gases.

* A paper read at the fourteenth meeting of the American Society of Mechanical Engineers by William Kent.

IT is reported that the municipality of Berlin have arranged with the Gas Association supplying the city for a reduction in the price of gas used for motive power to about 88 cents per thousand feet.

IT has been announced that the Russian Government is prepared to grant a concession for the petroleum pipe-line from Baku to the Black Sea, a distance of 600 miles. According to estimate the line will cost £2,000,000, and a suitable company will have a monopoly for twenty years. The line is to be large enough to convey 160 million gallons of crude petroleum to Batoum or Poti per annum, and when the traffic reaches 90 per cent. of the total, the company is to lay down a second pipe-line. The tariff to be charged ranges from 12*s.* to 13*s.* per ton of oil. As regards the iron pipes used, two-thirds can be foreign, but the remainder must be Russian, if possible. The pipe-line to be completed in three years. When finished refined petroleum in London will fall to about half its present price, and be sold at 3*d.* per gallon. The Standard Oil Company of America, however, is expected to adopt the bulk system of transport at once, so that, long before the Russian pipe-line is finished, the best lamp-oil will have dropped to that price here.—*Gas and Water Review.*

MR. L. TIETJENS, of Stassfurt, Germany, has recently patented a very ingenious method of damming back the flow of water in shafts by the application of the well-known fact that certain salts increase their volume very materially by the absorbing of water of crystallization in hardening. To accomplish this, he takes either calcined soda, anhydrous alum, kieserite, or oxychloride of magnesium, mixes them into a paste, and then immediately injects them through a suitably arranged pipe into the fissures through which the water flows. As this paste hardens, it swells enough to fill all the interstices of the rock and render it thoroughly water-tight.—*Industries.*

WATER-PIPE.

AS NOTICED in our last issue, Mr. A. H. Howland read a paper on water-pipes at the meeting of the Philadelphia Engineers' Club, on December 4. We now give an abstract which we then were not able to do. As to cast-iron pipe he says:

"In relation to the strength of pipes, it is a simple matter to calculate the resistance of a perfect cylinder, made of a certain quality of material, against an internal pressure; but until you are willing to pay a fair price and insist upon good material and good workmanship, we must pay for an excess of material sufficient to insure us against the poor quality of the material and the carelessness of the workman. Just what percentage to add to the minimum thickness of pipe, for all these things, is a little uncertain, but, from a careful examination and study of all the data obtainable from 500 different works in the United States and Canada, I have concluded that—for all we have to guard against, either in quality of material, carelessness in manufacture, carelessness in handling or laying, or against water-hammer—a factor of safety of five is ample, and this only on the larger pipes.

"At the present time it is perfectly feasible to obtain pipes made of material having a tensile strength of 18,000 pounds to the square inch, and, with such material, the minimum thicknesses of various sizes of pipe, together with their weights and ultimate strength, are as follows:

Internal diameter.	Minimum thickness.	Weight per ft. of cylinder.	Weight per ft. of pipe laid, inclding bells	Weight per length to lay 12 ft., including bells.	Ultimate strength if made of 18,000 lb. iron.	One-fifth of the ultimate strength.
4	0.32	13.57	14.67	176	2880	576
6	0.35	21.82	23.83	286	2100	420
8	0.37	30.43	33.00	396	1665	333
10	0.40	40.83	44.33	532	1440	288
12	0.45	55.00	59.83	718	1350	270
14	0.47	66.76	72.75	875	1210	242
16	0.50	80.99	88.42	1061	1125	225
18	0.52	94.54	102.25	1227	1046	208
20	0.55	110.95	117.92	1435	990	198
24	0.60	114.89	156.50	1875	900	180
30	0.70	210.97	227.00	2724	840	168
36	0.80	289.04	310.75	3729	800	160
40	0.85	340.87	369.25	4431	765	153
42	0.90	379.03	410.58	4927	770	154
48	1.00	481.02	521.08	6253	750	150

After discussion of the above figures and of the facility with which he considers a 6-inch pipe of but three-tenths of an inch in thickness can be successfully tapped for service connections, the author proceeds:

"In the reports from 38 different places using 24-inch pipes under various pressures, I find one place using pipe weighing as light as 182 pounds to the foot, which would be about seven-tenths of an inch in thickness; while another works, under the same pressure and probable circumstances, uses pipes weighing 306 pounds to the foot, or about 66 per cent. in excess of the lighter. I do not know that I have strength of conviction enough to advocate the use of 24-inch pipe only six-tenths of an inch in thickness, for any works where there is any pressure at all, although my estimates and figures show that it would be perfectly safe, but it is so radically different from custom, that I have, to a certain extent, given way to custom and prejudice and have adopted as standard weights for all pipes used in works contracted for by myself, as follows:

Internal diameter.	Thickness, inches.	Weight per ft. of cylinder.	Weight per ft. of pipe laid, including bells.	Weight per length of pipe to lay 12 feet.	Ultimate strength when made of iron having tensile strength of 18,000 pounds.	One-fifth of the ultimate strength.
4	0.40	17.27	18.75	225	3600	720
6	0.42	26.46	28.92	347	2515	503
8	0.45	37.33	40.50	486	2025	405
10	0.50	51.54	56.17	673	1800	360
12	0.55	67.76	73.75	885	1650	330
14	0.58	83.02	90.67	1088	1490	298
16	0.60	97.78	106.78	1281	1350	270
18	0.64	117.11	126.67	1520	1280	256
20	0.70	142 25	153.43	1841	1260	252
24	0.80	194.77	210.33	2524	1200	240
30	0.90	273.00	285.33	3524	1080	216
36	1.00	363.22	390.50	4686	1000	200
40	1.10	443.82	480.83	5770	990	198
42	1.16	491.49	532.42	6389	995	199
48	1.30	629.16	681.58	8179	975	195

Cement-lined pipes, so-called, are next discussed. Their mileage is given as next to that of cast-iron, and the attractive feature of their cheapness in first cost noted. As to the results of their use the author says:

"Three years ago I sent personal letters to every department whose address I could obtain, throughout the United States and Canada, that had ever used wrought-iron cement-lined pipe, and received a very large number of replies From a careful study of these replies I find that the average life of the cement pipe, as usually made, was eight years, and that no place, with two exceptions only, who had had these pipes in use for a longer period than eight years, recommended them.

"The objection to this class of pipe is: first, cement mortar, composed of one-half sand and one-half cement, is not an impervious material, and water, under ordinary pressure, is forced, to a greater or less extent, through it, and so comes in contact with the shell, which it eats until it has no strength left, when the pipe is destroyed. In examining many miles of this pipe which has been taken out and replaced with cast-iron, I have noticed that wherever a joint was made and covered with neat cement, the iron has been in almost as good condition as the day the pipe was laid, and this gives rise to the belief that a wrought-iron shell, lined and coated with neat cement, would have greater durability and life than one lined and coated with cement mortar. Whether such a pipe can be perfectly made or not is a serious question, and is the only question which prevents a much larger and more general use of this kind of pipe. The many manipulations necessary before the pipe is complete in the trench, and the fact that both the lining and coating depends, for its efficiency, upon the manipulation of mechanics, allows too many possible mistakes or errors to creep in and so render the pipe imperfect."

Wrought-iron coated pipes are next considered, with their advantages, and the objections thereto on the score of durability, with the various processes which have been devised for their preservation. The author says:

"It is my opinion that wrought-iron pipes treated in some one of the methods indicated, or in some method yet to be discovered, will soon supersede, in most cases, all other kinds of pipe."

Wooden, earthenware, composition, and glass pipes are noted in concluding the paper. All but the latter the author treats as of little general importance. As to glass pipes, he says:

"Glass pipes, of large diameter, have not been successfully produced, but it has been predicted, by several large glass manufacturers, that it will not be long before some method of casting these pipes successfully and cheaply will be devised.

"Made in form similar to our present cast-iron pipes, with some suitable device for a joint, and of malleable glass, they would form a water-pipe to which there could scarcely be an objection; strong, tough, smooth, and indestructible, and made of a material that is found almost everywhere. It is not without the range of probability that whenever a large quantity of pipe is to be used in any one locality, a furnace will be erected and the pipes made where they are to be used."

SANITARY INSTITUTE OF GREAT BRITAIN.

AT an examination, held November 11 and 12, sixty-four candidates presented themselves—nine as local surveyors and fifty-five as inspectors of nuisances. The following questions were set to be answered in writing on the 11th, and the candidates were examined *viva voce* on the 12th. The institute's certificate of competency to discharge the duties of local surveyor was awarded to John Reid Anderson, John F. Curwen, John William Metcalf, Charles Chambers Smith; and the institute's certificate of competency to discharge the duties of inspector of nuisances was awarded to James Barfoot, John Barron, Daniel Bartley Bostel, G. Stanford Bostel, Harry D. Bowyer, Edmund Bradshaw, Charles E. Brown, Albert Chadderton, David Christie, William Hatch Clayton, George William Cobham, John J. Elliott, John William Hart, Albert Hodges, William Lee Holding, Joseph Huxley, Joshua Jameson, Edgar E. Jury, Richard C. Lindop, Arthur Henry Lukes, Charles MacMahon, R. McCulloch, Adam Luke Macdonald, William Edwin Newberry, John Henry Ollett, William Parsons, William Robert Pearson, Charles Poole, Christopher Raimes, George Russell, Ambrose J. Shore, Charles Chambers Smith, Edwin Smith, Henry Charles Soper, Henry Spadaccini, Alfred William Stone, William Tate, John Tunstall, Samuel Turner, James A. Webb, Charles Turle Wilson, Charles Bruce Wood.

EXAMINATION OF LOCAL SURVEYORS.

1.—Mention the chief public health and other acts in force relating to:

(*a*) Water-supply.
(*b*) Sewerage.

Give a brief statement of the main features of each.

2.—Define a by-law. What is meant by (*a*) provisional order, (*b*) special drainage district, (*c*) contributory place, (*d*) inquiry by Local Government Board, (*e*) power of entry.

3.—What are the chief principles to be observed in the sewerage of a town or district, and how would you proceed to determine the size and capacity of an outfall sewer? What size of sewer would you propose for a town of 20,000 population where the gradient is 1 in 300? Illustrate your answer by sketches.

4.—Write a specification for laying stoneware pipe-sewers.

5.—Supposing a sewer to have a gradient of 1 in 300, how much would the velocity and discharge be increased by altering the gradient to 1 in 100?

6.—Give a description of the process termed intermittent downward filtration. State what area of land you would require with a gravelly soil for applying this method of purifying sewage to a town with a population of 20,000 inhabitants, and state the arrangements you would adopt for dealing with the rain-water falling on the roofs, yards, and streets.

7.—Describe and illustrate by sketches the essential points to be observed in carrying out a system of house-drainage and the best means of providing urinal and closet accommodations for schools, workhouses, and similar institutions.

8.—In arranging the water-supply for a manufacturing town of 30,000 inhabitants, state what you consider of importance as to—

(*a*) Sources of supply,
(*b*) Quantity required,
(*c*) Distribution.

9.—Describe the general characters of the waters derived from—

(*a*) The chalk,
(*b*) The new red sandstone,
(*c*) The carboniferous formations,

and the methods by which water should be obtained from each.

10.—In what ways is water liable to be polluted after collection, during its distribution to houses, and in houses? What means would you adopt to prevent such pollution?

11.—What fittings and plumbers' work generally are required for a high-pressure constant water-service? How would you make the connection with the main? Describe the kinds of joints which should be used on the branches.

12.—There is a great difficulty in obtaining a supply of good water for a country house, and it is therefore necessary to obtain as much water as possible from the roofs and to use it for drinking and cooking purposes. The total area of the roof of the house and offices is 8,000 square feet, and the average annual rainfall is about 40 inches. Calculate what size the storage-tank should be, and give a sketch of it and of its appendages.

13.—To what extent does the size of a room affect the quantity of fresh air required for effective ventilation, and what quantity of air would be required per hour for a room containing 8,000 cubic feet, occupied by 15 people? How would you ventilate such a room? Illustrate your answer by sketches.

EXAMINATION OF INSPECTORS OF NUISANCES.

1.—State the provisions of the Public Health Act with respect to cellar dwellings?

2.—In obtaining for analysis samples of articles that are suspected of being adulterated, what is the order of procedure prescribed by the "sale of Food and Drugs Act?"

3.—What is meant by a fresh-air inlet for drains, and what is its object? Illustrate your answer by a sketch.

4.—Describe some simple methods of ventilation which you would recommend for dwelling-rooms?

5.—In inspecting premises for the purpose of ascertaining whether the water-supply is wholesome, to what points would you direct your attention—

(*a*) In the case of a water-supply derived from wells?
(*b*) In the case of the water being supplied from a town main into a cistern?

6.—How is the disinfection of rooms provided for by law? After a case of scarlet fever how would you disinfect—

(*a*) The room?
(*b*) The clothes and bedding in it?

7.—In what circumstances can the use of earth-closets be recommended? Are they suitable for large towns? State the reason for your opinion.

8.—What are the chief points to be considered in framing by-laws for the construction and regulation of slaughter-houses?

BAD FOR THE PASSAIC'S REPUTATION.

AFTER drinking a glass of Passaic water on Tuesday, a prominent prohibitionist of Elizabethport dropped dead.

The Passaic River has for a long period been a menace to the good health of the towns in New Jersey that depend upon it for their drinking supply, but the death on Tuesday at Elizabethport of a gentleman immediately after drinking a glass of the water caps the climax.

What makes the matter worse is the victim was a life-long prohibitionist. If a prohibitionist can't stand it, what show has the average devotee of applejack, who scarcely knows what water is when he sees it?—*N. Y. Herald.*

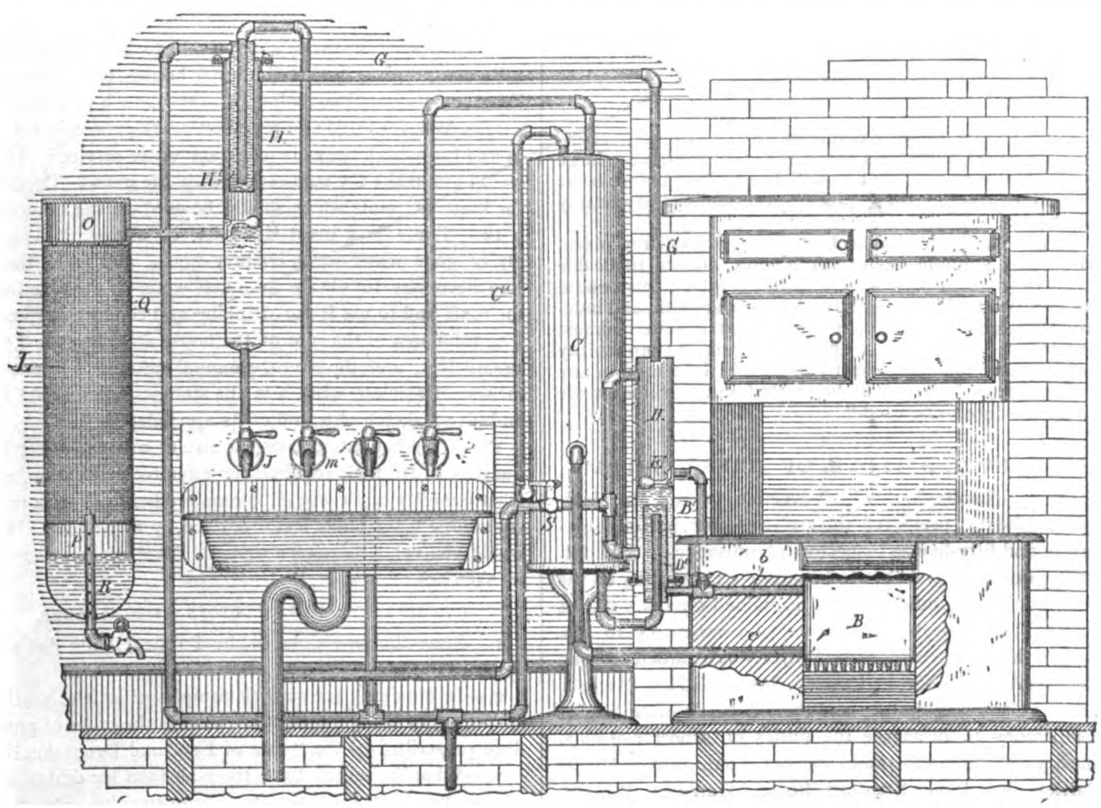
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

DOMESTIC WATER-DISTILLING APPARATUS.

THE accompanying drawing shows an apparatus in connection with a kitchen range and boiler for making distilled water for domestic purposes, lately invented by Abram G. W. Rankin, of Jersey City, N. J.

The boiler is supplied with cold water in the usual manner. The hot or upper pipe from the water-back (*b*) is connected with the evaporating apparatus by the branch-pipe B', which terminates at E with the cylinder-tank D, the end being covered and operated with the ball-cock E. Within the cylinder D is a smaller one D'. This is the heater or evaporator. When the water falls, by being evaporated in D, the valve or cock E opens and admits water from the flow or hot pipe from the water-back through the branch into the cylinder D. Here the excess is evaporated by the heat of the water in the inner cylinder as it passes to the kitchen-boiler, the vapor thus formed being driven over through the pipe G to the condenser H. The water



drawn at the sink through the cold faucet *m* is circulated through the inner chamber of the condenser (H'), extracting the latent heat from the vapor and allowing it to fall into the receiver K. From this point it may be drawn at the faucet J, or it may be allowed to overflow into the chamber O of the apparatus L. In passing from the chamber O to collecting-chamber R at the bottom, it falls through air within the wire-formed cylinder, the purpose being to aerate it before it is drawn at the lower faucet.

A safety-valve is placed at S to prevent rupture by over-pressure if the latter becomes possible.

[NOTE.—Our illustration is made from a patent specification, which shows the lower pipe of the water-back connected with the side spud of a kitchen boiler and the upper pipe with the bottom of the boiler after it passes through the evaporator. This, presumably, is a mistake of the draughtsman, as these pipes would have to be transposed before the circulation from the water-back would go on in the direction required.—ED.]

THE PENNSYLVANIA HEALTH REPORT.

WE take great pleasure in welcoming the appearance of the first annual report of the State Board of Health of Pennsylvania, which forms a handsome volume of 361 pages, with numerous illustrations, and containing in a side pocket a convenient map of the State, showing the relative distribution or density of population in different sections.

It marks the commencement of a new series of health reports, which, to judge from this specimen, bid fair to be of much interest and value, both as educational documents which will aid in forming an intelligent public opinion as to the necessity for and utility of State and municipal sanitary organization, and also as contributions to knowledge.

This report contains copies of the law creating the board, and of its by-laws and the minutes of its proceedings, and a number of appended reports and papers, of which the most important are: The report of the committee on water-supply, drainage, sewerage, etc., which has been already noticed by THE SANITARY ENGINEER AND CONSTRUCTION RECORD in its remarks on river pollution, issue of December 11; a paper on the proper organization of boards of health by the Secretary, Dr. Benjamin Lee; an illustrated report on the sanitary condition of Harrisburg, by Dr. Hugh Hamilton; a series of three reports relating to the Plymouth epidemic of typhoid, the last of which, by Dr. M. S. French, fixes the cost of the epidemic at a little over $97,000; a report on typhoid and typhoid-malarial fevers at Rosement; a series of reports on the results of sanitary inspections of several localities; a series of reports on quarantine and disinfection, and copies of circulars and forms issued by the board.

The quarantine reports relate mainly to the regulations of the port of Philadelphia.

The Secretary of the Board remarks that "the first and most pressing want of the State, from a sanitary point of view, is the organization of boards of health in the rural districts." While this is certainly important, we should consider that the most urgent sanitary need of the State was for a proper system of registration of vital statistics which would give both State and local boards of health positive definite information as to where sanitary work was needed, what kind of work was needed, and whether they were doing any good. Such a system Pennsylvania has not got, and cannot have under its present law, but without such a system no public health organization has any firm foundation, or can hope to do continuous good work that shall be recognized as such by the people, the legislature, and the courts.

AT the semi-annual meeting of the State Board of Health of Kentucky, held at Louisville, November 23, the Secretary, Dr. McCormack, reported that public health work is going on well in many counties, but that in many other localities there are either no health boards or they are not efficient. He remarks that:

"In the presence of small-pox, so far as opportunity for observation has occurred, even the least efficient boards wake up to an activity which meets all the requirements, and there are members of our boards of health who seem to have the erroneous idea that such boards were only organized to prevent this, the most easily managed, and, as our mortality tables will show, the least fatal of our domestic plagues, while a high death-rate from typhoid fever, diphtheria, dysentery, and even scarlet fever, often fails to furnish incentive for official industry; and the gathering of facts bearing on the local or other causes of sickness and deaths, which must form the basis of all permanently useful sanitary work, seems to have no sort of attraction for this class of workers. It will probably occasion some surprise when it is said that this want of interest in preventive medicine is more apparent in the cities and large towns than in the smaller towns and country districts, but such, an experience of three years as your executive officer leads me to believe, is the case as a rule. This is difficult to explain in the face of the facts, that in cities the large aggregations of population, with the attendant pollution of soil, water, and air, and the consequent large mortality, coupled with better salaries for health officials, and a supposed higher cultivation of the medical profession, lead one naturally to suppose that official vigilance in this direction would be both more required and appreciated. It is probably because, under the old system, the health officer was more frequently selected by City Councils from political considerations than for his special fitness for the work. If this be true, we may hope for improvement under the new law, when municipal health officers will be appointed by, and be responsible to, the Board of Health, and not the Council."

These remarks apply to other States as well as to Kentucky.

TO FIGHT PLEURO-PNEUMONIA.

THE Committee of the Consolidated Cattle Growers' Association of the United States, appointed to prepare and present to Congress a bill for the extirpation of contagious pleuro-pneumonia and like diseases among cattle, are perfecting a bill which proposes the appointment, by the President, of a commission of three, with ample powers to discover, quarantine, appraise, slaughter, and pay for diseased and exposed cattle, and to establish rules and regulations to have the force of law when approved by the President.

PERSONAL.

C. SHALER SMITH, M. Am. Soc. C. E., died at St. Louis December 19. Mr. Smith became a member of the American Society of Civil Engineers in 1873, and was a director of the society in 1877 and 1878.

CAPTAIN WILLIAM H. BIXBY, U. S. Engineer Corps, has been ordered to proceed from Wilmington, N. C., to Fort Macon, N. C., on public business.

CAPTAIN C. B. SEARS, Engineer Corps, in addition to present duties has been ordered to relieve Captain D. C. Kingman, in charge of the construction and repair of roads and bridges in the Yellowstone National Park.

JOHN ROACH, ship builder, is seriously ill with cancer.

MR. E. L. CORTHELL, Mem. Am. Soc. C. E., delivered an address last Monday evening before the New York Academy of Sciences on the proposed ship-railway across the Isthmus of Tehuantepec.

GENERAL W. F. SMITH (Baldy Smith) is being urged for Superintendent of the U. S. Coast Survey.

THE thirty-fourth annual meeting of the American Society of Civil Engineers will be held in this city January 19 and 20.

THE Worcester, Mass., Society of Civil Engineers has assigned subjects for papers as follows: "The Minnehaha Bridge over the Mississippi River, near Minneapolis," by George H. White, C. E.; February: "Steam-Heating," by E. K. Hill, M. E.; March: "Public Parks," by A. J. Marble, C. E.; "Government Surveys and the Use of the Solar Compass," by F. A. McClure, C. E., date not assigned.

THE Surveyors' and Civil Engineers' Society of Iowa held a meeting at Des Moines, December 15. A committee was appointed to draft a bill defining the duties and regulating the practice of county surveyors in the State, and the following officers were elected: President, Seth Dean, Glenwood; First Vice-President, F. L. Easley, Fort Dodge; Second Vice-President, James McClure, Lohrville; Treasurer, M. R. Laird, Des Moines; Secretary, Frank Pelton, Des Moines. Resolutions were passed instructing the Secretary to publish the proceedings of the convention.

THE Texas Society of Civil Engineers, at a meeting in San Antonio, December 7, had up the question of the practicability of burning the garbage of that city. The furnaces at Leeds, England, and the Zellwegen furnace, of Chicago, were explained with the aid of drawings.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15 NUMBER 5. PUBLISHED EVERY SATURDAY.

NEW YORK, JANUARY 1, 1887.
LONDON, JANUARY 15, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 140 William Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ———& Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & CO., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

WATER MONOPOLIES.

THE furnishing of a water-supply to a small town can frequently be better accomplished by private than by public enterprise, and no really forcible objection can be made to the control of water-works by a local corporation composed chiefly of citizens who are interested in the welfare of their town and amenable to public sentiment to a considerable extent.

The case is different, however, with the supply of a large city, where the interests involved are so varied, the territory covered so extensive, and the amount of capital required so large as to preclude the possibility of personal responsibility of the owners to the public, or of the work being undertaken and managed in any other light than that of a business enterprise, in which every advantage is to be taken by those who have invested their money in it, the other party to the contract being the public, represented by elected officers. How the individuals who compose the great body of the public generally fare in such contracts is too well known to need explanation here. The feeling is pretty general in the large cities that their water-works should be controlled by the public, and out of the fifty largest ones in the country only nine have allowed private corporations to furnish the water, and in nearly every one of them the number of water-takers is only about one-third of the number in towns of corresponding size which own and control their own works.

But of late a new method of working the scheme of controlling the supply has been broached. Large private corporations have been formed, on paper at least, with the view of controlling sources of supply rather than the distribution of the water, leaving the latter to municipal control. The first of these schemes, so far as we are now aware, was that for bringing the waters of Lake George to New York City, promulgated in 1881, in one of the reports on which appeared that memorable sentence: "The hoary hypersthenic crests of the Adirondack Mountains, our proposed water-shed, that pierce the clouds and condense the ever-flowing stream of aerial moisture, are themselves their only historians." This project was investigated by officials and citizens, and the universal judgment of the solid part of the community condemned it.

More recently another huge scheme has been projected, and a corporation is reported to have been formed for supplying all the cities of Eastern New Jersey from the water-shed of the Upper Passaic River, and extending the benefits of the system to New York City also. This corporation claims to have secured a monopoly of the rights to use the water of the Passaic River, and has made a proposition to Jersey City to furnish it with a supply of water at a stipulated rate per million gallons. The source of their supply is as inspiring as that of the Lake George Company, for an officer of the company stated to a reporter that "it is in the midst of a region where the rugged granite mountains lift their heads to receive the kisses of the clouds as they descend from heaven to bless and enrich the earth below."

A rebuff from the Water Commissioners of Hoboken, to whom the company had previously offered the "kisses of the clouds" they pretend to monopolize, does not seem to have dampened, or more properly perhaps, dried, their enthusiasm, for they succeeded a few days ago in inducing the Jersey City Board of Works to endorse their project and agree to take their water. Fortunately, however, there is another municipal body called the Board of Finance, whose consent is essential to binding the city to contracts, and this board so far appears to be opposed to committing the city to purchasing from a private corporation that which they do not yet control, and paying for it more than the city could build and maintain the works for. But even if the proposition of the company were pecuniarily somewhat favorable to the city, which it does not appear to be, the whole scheme is not commendable on grounds of public policy.

SOIL POLLUTION.

IN the numerous papers and discussions upon the causes of epidemic and preventable diseases which have appeared during the last fifteen years much has been said about soil pollution and soil infection as a factor in their production or spread, and probably all of our readers have a more or less definite idea as to the meaning of these terms.

Soil pollution must always be a somewhat vague and indefinite phrase, because it involves the question of the quantity, as well as of the character of the substance or substances whose presence in the soil constitute pollution. All soil with which the municipal engineer or sanitarian has to do contains undecomposed organic matter, and, in almost all of it, some of this organic matter is of animal origin, which is usually recognized as polluting; but when we say that a soil is polluted we mean that it contains a sufficient quantity of such matter to make the fact easily recognizable without having recourse to delicate chemical or microscopical tests. As a rule, a polluted soil communicates to water passing through it, or to the air above it, either organic matter in a state of decomposition or some of the products of such decomposition. The exceptions to this are few, and occur chiefly in connection with the waste products of certain manufactories—such as alkali waste, for example, which gives off sulphureted hydrogen.

The forms of soil pollution which are of the most practical importance are those due to the deposit of decaying garbage and offal in the filling in of hollows in cities, and to the leaching or soakage of excrementitious matters from cess-pools, privy-vaults, etc., or from the surface of streets.

The effects of soil-pollution vary greatly according to the season of the year, the amount of moisture present, the use made of the contaminated subsoil-water, and, most of all, upon the character of the micro-organisms which live and flourish in the organic matters. In the majority of cases these micro-organisms are of a kind that do good work in decomposing such matters and in sterilizing their vicinity by giving out products which are poisonous to other and more dangerous forms of bacterial life. The greater the proportion of air in the soil, the more porous and the drier it is within certain limits, the more active are these harmless micro-organisms, and the more quickly and thoroughly will they do the work of purification. A certain amount of moisture is necessary for them, for absolute dryness puts a stop to all growth of bacteria even if it does not entirely destroy their life.

When, to a polluted soil, certain forms of bacteria capable of producing specific disease

gain access, under favorable conditions for their growth, we have soil infection produced. The specific diseases which may be connected with specific soil infections are not yet well known, but there is good reason for thinking that anthrax, cholera, typhoid fever, and yellow fever belong to this class, and in one sense malarial fevers belong to the same category.

The infection of soil is produced by bringing in contact with it the discharges or excretions of those affected with specific diseases, or by burying in it the bodies of living beings who have died from such diseases. Hence the danger that a soil will become infected is proportionate to its liability to pollution with excreta, for where sewage which is not specifically dangerous goes is the place where the dangerous sewage is most likely to go.

A soil may be polluted for months or years without being infected, but it is always liable to infection, and in many cases it produces discomfort, nuisance, and even disease, when it cannot produce specific disease.

The prevention of soil pollution in the vicinity of human habitations is one of the most important branches of municipal hygiene. What is to be done with a soil already polluted is a question which we will discuss hereafter.

OUR BRITISH CORRESPONDENCE.

New Street-Sweeping Machine—Gas-Stoves, Meters, etc., not liable to distraint—The proposed Cemetery at Sutton.

LONDON, December 15, 1886.

A NEW street-sweeping machine has been patented by Henry Whiley, of the Manchester Health Corporation, which combines the features of an ordinary sweeping-machine and of a mud-elevator. A long brush is hung on a frame, diagonal to the axle, and revolves by friction gearing. Following behind this brush are a series of ordinary brush-heads on a continuous chain, which sweep up the ridges of mud left by the long brush, into elevators, also on a continuous chain, by which the mud is carried up and precipitated into a tank overhead. These revolving brushes are also driven from the axle, the whole machine being on one frame-work. Considerable saving is, of course, effected by the operations of sweeping and collecting being done at the same time.

A decision of interest to gas companies has recently been decided in the Court of Appeal. It is customary for gas consumers desiring such apparatus to rent from the company supplying them with gas either heating or cooking stoves. In a recent case of distraint for rent, such a fixture was seized with other articles on the premises, and the gas-light company took objection to such seizure in the Law Courts. The judges in appeal held that under the 14th section, Gas-Works Clauses Act 1847, setting forth that "the undertakers may let for hire any meter * * * or any fittings for the gas * * * and such meter and fittings shall not be liable for distress for rent of premises" of user, the apparatus was exempt from seizure—a decision doubtless satisfactory to the gas companies, but perhaps questionable from the point of view of an ordinary creditor (or even non-resident lodger), whose goods *may* be distrained upon if they happen to be on the premises.

In giving evidence at a Local Government Board inquiry into the proposed cemetery at Sutton, Professor Attfield made the following statement of interest to municipal and other authorities, in whose hands is the decision of location of plots of ground for burying purposes. He objected to the site proposed, because of the chalky nature of the soil. Interments in chalk were objectionable, as compared with gravel or sand or clay, because the chalk did not contain the purifying substance found in gravel or red sandstone—*i. e.*, oxide of iron.

SAFETY VALVE.

OUR Milwaukee correspondent writes that the City Attorney has been instructed to take steps to stop the further publication of an advertisement of a mineral-water company which asserts that the water supplied to the city is contaminated with sewage.

ENGINEERING & ARCHITECTURE

OUR SPECIAL ILLUSTRATION.

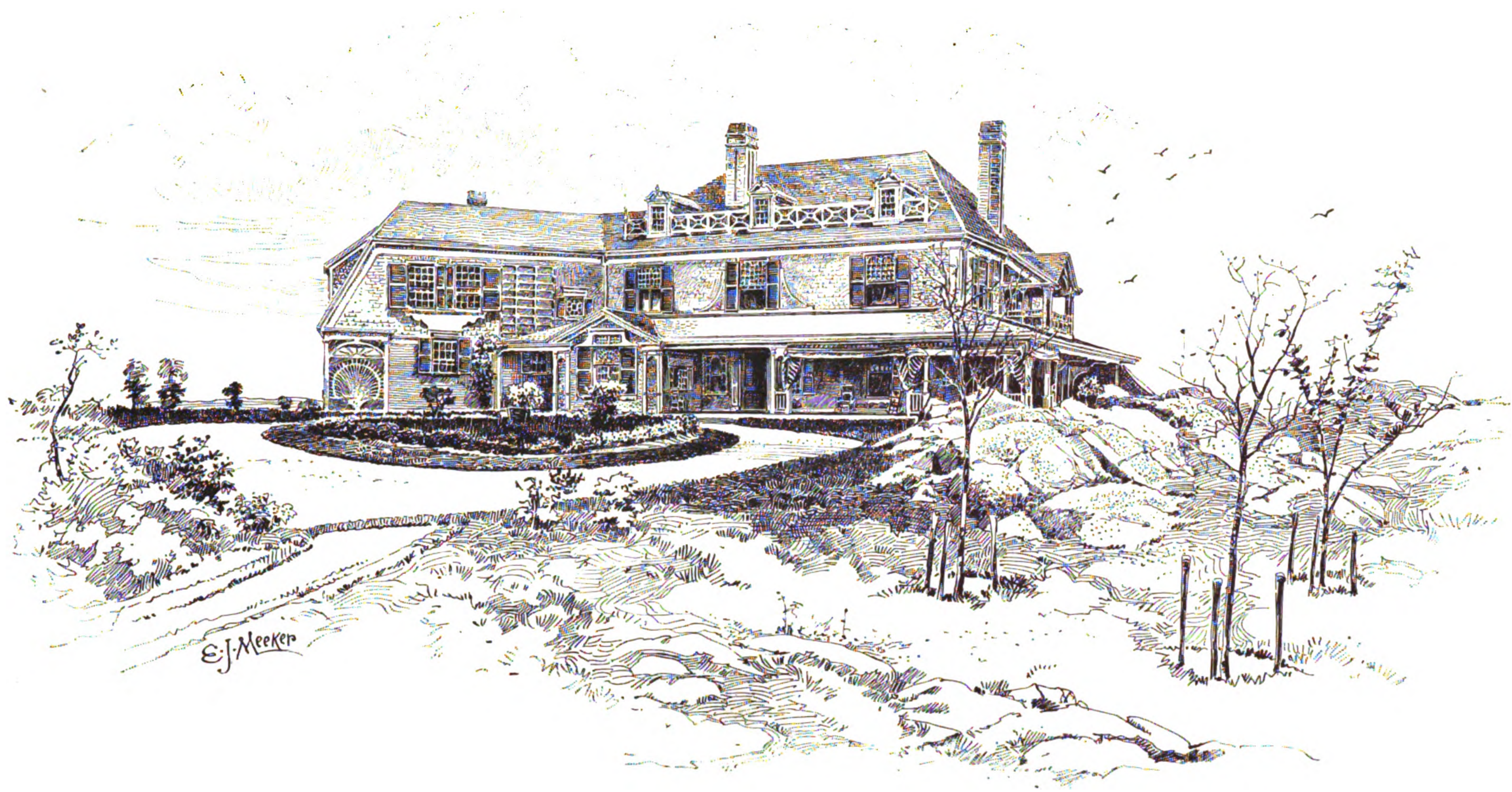
RESIDENCE OF G. D. HOWE, AT MANCHESTER, MASS.—ARTHUR LITTLE, ARCHITECT, BOSTON, MASS.

OUR special illustration this week shows the residence of Mr. G. D. Howe, at Manchester, Mass. The building is of wood, the finish is colonial, and the woodwork generally painted. Arthur Little, of Boston, was the architect.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

THE subject of our vignette illustration this week is the Mentmore Entrance Lodge, England. The architect was Mr. M. P. Manning, of London.

MENTMORE ENTRANCE LODGE.—M. P. MANNING, ARCHITECT, LONDON, ENG.

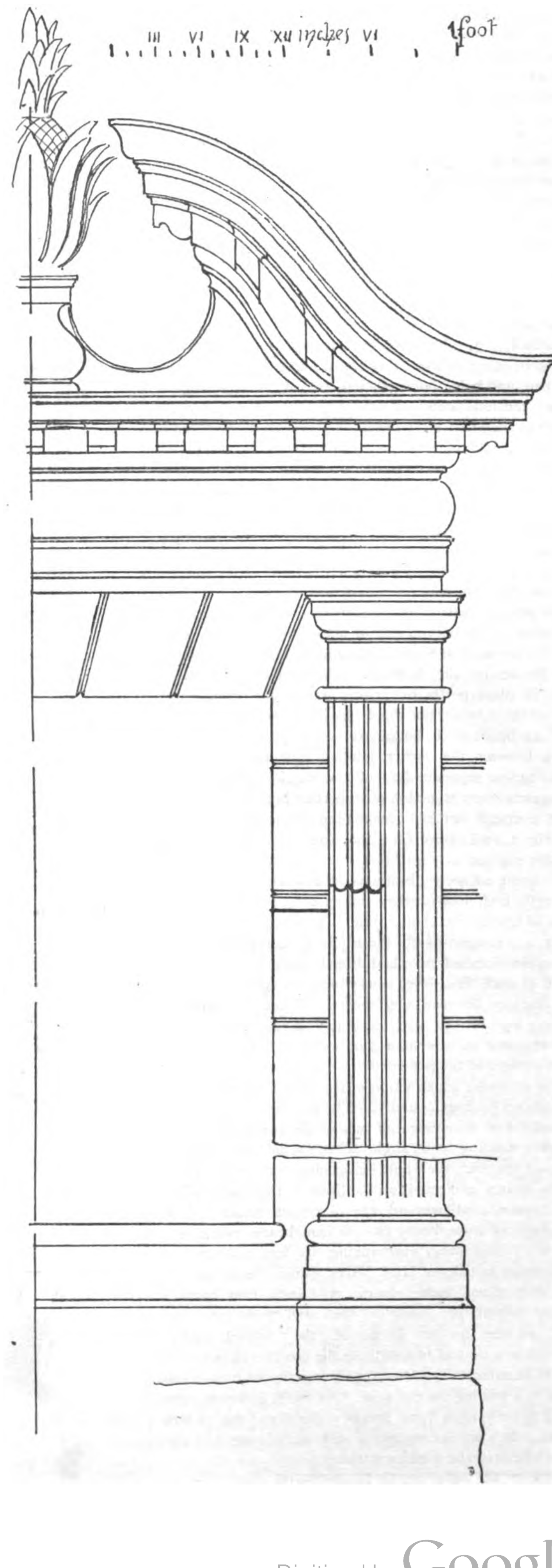


RESIDENCE OF G. D. HOWE, MANCHESTER, MASS.

ARTHUR LITTLE, ARCHITECT.

·Sketch·

DETAIL of DOOR



·PINEAPPLE · HOUSE· ·SALEM · MASS·

BUILDING CONSTRUCTION DETAILS.

No. I.

THE PARKER HOUSE, BOSTON.

Two years ago the Parker House, Boston, was extended so as to cover the whole of the lot occupying the corner of Tremont and School Streets. From the angle of the new building was projected a circular oriel-window, extending through three stories, and constructed in quite an interesting manner.

Figure 1 shows the plan and elevation of the oriel. The column from which it springs in the lowest story is entirely detached from the building, standing by itself in the centre of a small corner vestibule, so that the corbelled base of the oriel is exposed on all sides. The walls above are of white marble in solid courses, ten inches thick, matching the rest of the building. At the top, the oriel is drawn in to the lines of the building by a conical marble roof. The main walls of the hotel continue for three stories above the upper part of the oriel, and are crowned by an attic story and a high slated roof.

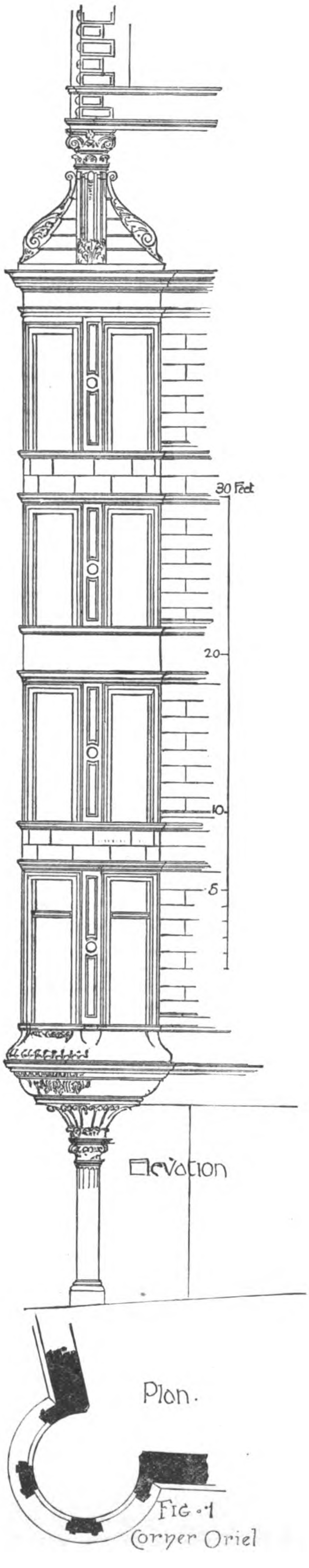
Figure 2 is a sectional drawing showing the manner in which the oriel is supported at the base. The column is eighteen inches in diameter, with two inches thickness of metal, and weighs about three tons. The shaft extends to just above the first course of masonry, where it is bracketed out to receive the heavy iron pan which constitutes the constructional base of the oriel. The pan is shown in plan by Fig. 3. This iron-work is tied to the main walls of the building by five heavy 12-inch iron beams entering the pan, and being bolted thereto at A A. These lines of beams continue along both fronts, forming a lintel course over the wide first-story openings. Where they enter the pan the cast flanges are kept up, as shown by the dotted lines of Fig. 2. The beams are bolted closely together, and secured to the pan by bolts dropped between the bottom flanges, and turned up from below. The pan weighs about five tons, and would seem to be abundantly strong to sustain any load which could come upon it, but as an additional security a 1x6-inch wrought-iron bar was shrunk about the top.

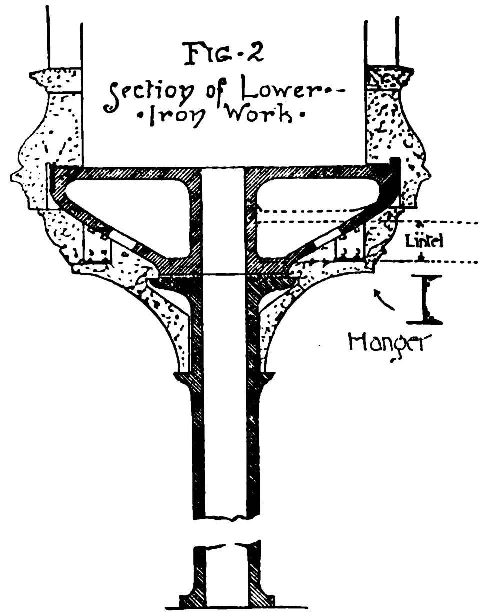
No part of the iron pan is exposed in the finished construction. The bottom ring of marble rests upon a ledge cast on the shaft of the column, and is further held by ties not shown on the drawing. The next course above is held in place partly by bearing on the projecting upper part of the column, but chiefly by iron hangers, of section like an inverted T, bolted to the iron pan, and dropped down between the vertical joints of the masonry, so that each hanger supports half of two adjoining stones, and conversely every stone has a support on both sides. The next course is notched over the top of the pan, as shown by Fig. 2, and above that the masonry is continued in regular courses.

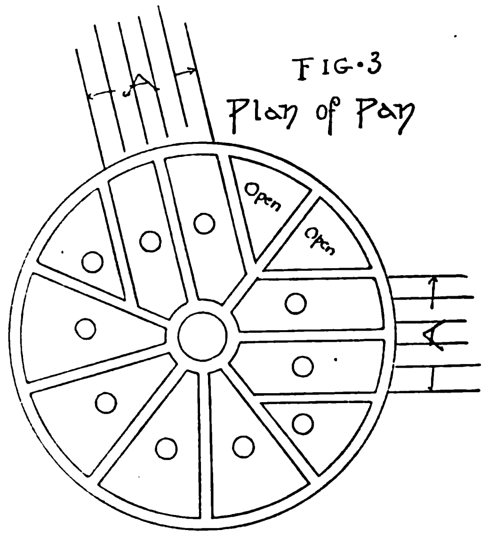
In order to secure lightness of construction as well as strength, each floor of the oriel is composed of a single plate of quarter-inch boiler-iron. The ceilings are furred down to correspond with the adjoining work, and the tile or wooden-finished floor laid directly upon the iron plate. Also, at each floor-level a 1x3-inch wrought-iron bar is laid flatwise between the courses of marble, extended entirely around the oriel, and tied across the opening into the bay by a similar bar, each end being carried twenty feet into the main walls.

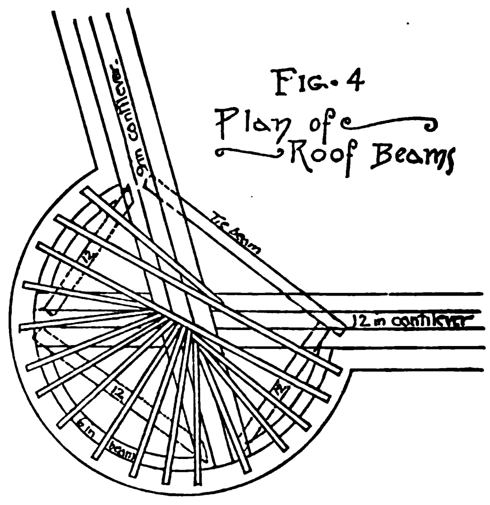
The crowning construction of the oriel is shown in plan and section by Figs. 4 and 5. The idea was that none of the weight of its stone roof nor of the two walls of the building meeting at an angle above should bear upon the walls of the oriel, the whole being supported by two cantilevers beams projected on the lines of the main walls. The lower cantilever on the Tremont Street side is composed of three heavy 12-inch iron beams twenty-two feet six inches long, overhanging six feet nine inches. The upper cantilever is of heavy 9-inch beams twenty-two feet three inches long. A 6-inch iron beam is carried around the inside of the oriel just below the level of the bottom flange of the 12-inch beams to serve as a tie and to distribute the pressure in case there should be sufficient settlement to bring the 12-inch beams down to a bearing on the oriel. As built, however, there was a ½-inch open joint between the 6 and the 12 inch beams. In a similar manner a wide plate is placed under the oriel end of the 9-inch cantilever.

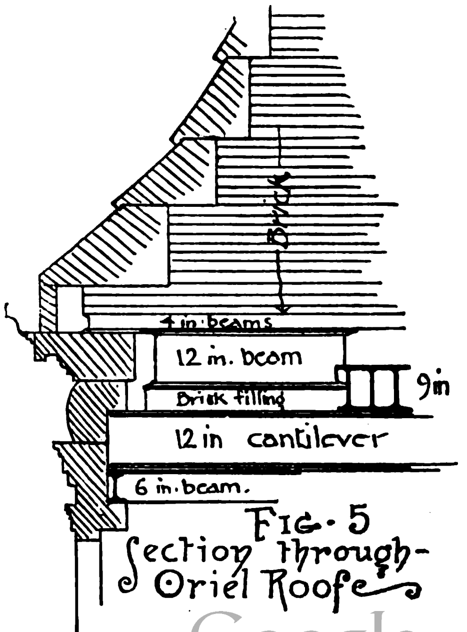
Between the outer angles formed by the cantilevers are placed three 12-inch iron beams, as shown by the dotted lines of the plan, with the tops a little higher than the top of the stone cornice. On this frame-work are laid a number of 4-inch iron beams filled in solid with brick-work.











The ends of these beams do not touch the cornice-stones of the oriel, the weight of the brick filling and the stone roofing immediately above being more than counterbalanced by the weight of the walls which meet over the centre. There is not likely to be any settlement which would effect any change in the conditions or bring the ends of the beams to a bearing, as the masonry of the oriel courses exactly with that of the main walls, consequently both would settle equally, if at all.

For those who are interested in following the construction below grade it may be stated that the iron column bears on an iron plate and a granite pier, each three feet six inches square, with two levelers six feet and eight feet square, respectively.

The weight of the oriel down to the iron pan is nearly forty tons, and the distributed load on the foundation is one and three-tenths tons per square foot.

The Parker House extension was built by the late T. E. Stuart, the general contractor, from plans of Mr. Gridley J. F. Bryant, architect. The iron-work was furnished by the G. W. & F. Smith Iron Company. Mr. Bryant superintended the construction of the entire structure, and was most ably seconded by his assistant Mr. J. F. Eaton.

MODERN SEWER CONSTRUCTION AND SEWAGE DISPOSAL.

BY EDWARD S. PHILBRICK, MEM. AM. SOC. C. E.

No. II.

(Continued from page 11.)

THE combination of house-refuse and street-wash in one system of collection by sewers constitutes what is commonly known as the "Combined System of Sewerage.' This system has met with a greater development than the one known as the "Separate System," which provides small sewers for house-drainage alone, the former having probably been adopted in over 90 per cent. of all towns and cities hitherto constructing sewers. In most cases good reasons appear to have existed for this combination, though the special advocates of the "Separate System" claim that grave mistakes have been made in so doing. Arguments at length on both sides of the question have been already published in THE SANITARY ENGINEER AND CONSTRUCTION RECORD, which can be briefly stated as follows: The combination has the merit of simplicity always, and of economy also, where sewage can be disposed of by delivery into the sea or some large river near the city, where pollution of the waters so receiving it need not be considered as a practical question. In all towns of such size and density of population as to require conduits for the collection of surface-water at all, a separation of the sewage requires not only a separate system of collecting pipes, but a separate outfall. The English maxim of sending the "rain-water to the brooks and the sewage to the land" is as good a one as can be devised for a general rule in a few words.

Such a separation may be practicable under existing circumstances in many towns where an increase of population and trade may soon render it impracticable, for this reason—viz., the greater the street traffic, the more difficult to prevent the street-wash from becoming too foul to be disposed of in the neighboring streams, or in any way other than as *sewage*. Many towns, as well as all metropolitan cities, have already reached that point. This limit is sooner reached in cold climates, and pretty surely in all latitudes above 40 degrees on the eastern slope of the American continent. In such cities the snow and ice accumulate for several months to such an extent as to imprison the solid and fluid exuviæ of animals and all other kinds of street filth, to be liberated suddenly during a thaw; when, often accompanied by rain, large quantities of foul water are poured into the sewers at once from the previous accumulation. No system of pipes adapted for the collection of house-drainage alone can cope with such a flow, and any stream or tidal water which can, without harm to the dwellers on its banks, receive and carry off such a quality of water, can also safely dispose of the house-sewage, for the latter is comparatively insignificant in amount, and contains no more impurities per gallon than the mixture of melted ice and filth from such streets.

All sewers constructed upon the combined system should provide for collecting all the water that can be drained into them during heavy rains, and hence their capacity is from ten to twenty times as great as those adapted to the collection of house-drainage alone from the same areas. In fact, very little account is made of the volume of the latter in such cases.

It is this consideration which makes a strong and valid argument in favor of the separate system in such places as a real separation of rain-water from filthy water is practicable. Such conditions often exist in small towns of a semi-rural or suburban character, where the street traffic is so limited that the street-wash is harmless if allowed to fall into the natural water-courses.

There are many inland towns, not located upon large streams, where the sewage cannot with propriety be allowed to discharge into natural water-courses, but must be either transferred to a considerable distance by pumping, or chemically treated to separate the water from the filth. In all such cases the elimination of the bulk of the water during collection becomes an important question of economy, and the separate collection of the house-drainage assumes a new importance. Effort should be made in such cases to exclude the rain-water in certain detached districts where found practicable, even if impossible to do so for the more densely-peopled portions of the town. This separation is often facilitated and rendered practicable by the presence of brooks or streams flowing through the town, which can receive the street-wash without harm, but which would become a nuisance if made the receptacle of the house-drainage. Thus the separate system can be used with advantage for the outlying and suburban districts, while the combined system is better adapted to the central and commercial part of the city. But as the suburbs of a great metropolis like New York or Chicago may in a few decades become urban and thickly peopled, regard should be had for such possibilities to avoid the construction of works that may become outgrown and useless in a few years.

Much has been urged by the special advocates of the separate system concerning its superior sanitary qualities. It is said that sewers constructed on the combined system are necessarily so large that the dry-weather sewage forms only a driblet in their bottoms. This is quite true. But if proper methods be followed in their construction, the experience of the writer does not show that such sewers necessarily become the deposits of filth to any dangerous degree. The oval form, with a narrow bottom, adopted in all the best modern practice, confines the small stream of dry-weather sewage to narrow limits, and if houses are properly protected against the ingress of air from the sewers no harm results in practice from the presence of the rarely-used surfaces of the larger conduit. London has for fifty years been sewered on the combined system, and has been steadily gaining in its recorded death rate. Judging from the writer's observation, it seemed more sensible to attribute all injurious collections of filth in sewers either to faults in their design and in their constructive details, or to faults of administration, rather than to consider them as the necessary consequences of the small flow in a large conduit.

The experience of the writer has proved that even in pipes of six inches in diameter a daily flushing from tanks specially provided therefor does not prevent the accumulation of a slimy coat of organic matter on the interior surface wherever kitchen-drains are discharged therein. In fact, no amount of flushing without other aids will keep clean the inside of a pipe which carries greasy water. The difficulty of preventing the flow of such water in the sewers is so great as to be practically insurmountable. The result is that small drains are about as foul as large ones, when the latter are equally well designed and constructed, so that the argument of greater cleanness as a certain result of the small pipes does not seem to be founded upon fact.

The first cost of a system of sewers for house-drainage alone is very small, often only one-fourth or one-fifth part of the cost of a combined system. But before making such a comparison, it must not be forgotten that the surface-water is likely to become a nuisance if not provided for in some way or other, and such provision should be taken into the account in making an estimate of cost. It often happens that natural streams flow through the town, giving a chance to collect street-water at a comparatively small cost, by short conduits of a limited size, laid nearer the surface than advisable for house-drains. The topography of every place must be studied carefully, in order to bring all such questions to the light to give due weight to all natural resources, before arriving at a conclusion in such an important matter which is likely to affect the future welfare and public economy of a community for a long term of years.

If a town is not intersected by any natural streams, its street-wash may in some cases be allowed to flow on the surface without serious inconvenience. This is purely a local question, but there are few towns enjoying such quickly-sloping ground as to render this course advisable after the buildings are constructed in continuous blocks. If a system of conduits are required for the removal of the street-water, the combined cost of such a system, and another for the collection of the sewage, may largely exceed the cost of combining the two in one, besides introducing a complication of pipes in the streets that it is always best to avoid if possible.

When constructing sewers on the combined system it is seldom, if ever, found necessary to carry the whole volume of storm-water through to the outfall, which is sometimes a considerable distance from the junction of the larger mains with one another. It generally happens that several opportunities occur either in the midst of a town or along its borders for discharging the greater bulk of storm-water into natural channels by overflows for occasional use. In case of severe storms, when such overflows are called into service, the volume of the rain-water is so great compared with that of the sewage proper that no harm results from such a discharge into a small stream, for the sewage is not only very largely diluted at such times, but the streams into which it is thus poured are swollen more or less by the same storm, so that they are rendered more than usually capable of carrying off the filth in a harmless way to such distances that the dilution soon becomes incalculable.

The location and details of such overflows must depend entirely on local topography, and experiment is sometimes needed in order to apply them of proper capacity, and at the proper places, for though the carrying capacity of trunk-sewers may be computed with approximate accuracy, the quantity of rain-water that may reach them within a definite time is not so easy to forsee. This depends on two elements: (1) The maximum rainfall per hour for a term of hours, which is sometimes found by previous observation and record within reasonable distance of the locality and for a period of years; (2) the character of the surface to be drained, whether flat or inclined, whether tight or absorbent.

This inclination is generally fixed by Nature to a large degree, but the tightness must depend on the ratio of roofed and paved surfaces to the gardens and fields within the area contemplated, as well as to the condition of the soil, whether loose and sandy, or clayey, and perhaps frozen. Moreover, in Northern cities, the actual rainfall in the spring is often supplemented by the sudden thaw of a mass of accumulated snow and ice, which, during a warm rain, adds its volume to that which is falling, to gorge the channels and conduits.

Such are the general considerations affecting the choice of a combination or a separation of the street-wash and house-drainage. It is plain that the question must be largely influenced by local circumstances, such as population, soil, climate, etc., and that hardly any two places can be found exactly alike in many of the governing data.

(TO BE CONTINUED.)

UNDERGROUND CABLE CONDUITS.

WE have recently had an opportunity of inspecting the system of underground cable conduits which has been devised by Messrs. Callender and Webber. A section of some hundred yards was laid down nearly twelve months ago at the Borough-road Works of the Anglo-American Brush Company, where we understand that it will shortly be open to the inspection of all who are interested. Some time ago the opinions of electricians were divided upon the question of metallic or non-metallic conduits; but of late the tendency has been to give a decided preference to the latter type, especially for cables conveying any large number of watts, whether as heavy current or as high electromotive force. An ideal underground system for the distribution of electricity must secure the adequate protection of the cables when laid, provide easy and rapid means of repair, and in the majority of cases foresee future extensions and furnish means for increasing the number of conductors without fresh excavations or reopening the roadways. It is claimed that Messrs. Callender and Webber's system fulfills each of these requirements in a very high degree. The material employed is a natural bitumen, a substance possessing very considerable mechanical strength, together with a remarkably low temperature co-efficient and a high insulation. It is impervious to water, and is unaffected either by gases or acids found in the soil. It can easily be bent to any required shape. The conduits are constructed in lengths convenient for handling, and we are informed that the work of jointing is very easily carried out by the application of heat; a collar of the same material is afterward passed over, making the joint as good as any other part. The conduits are supplied with any required number of channels; and iron boxes for drawing in the wires are placed at suitable intervals. We may add, in conclusion, that the price of the material is not high, and from the well-known durability of genuine bitumen the cost of maintenance ought to be very small indeed.—*Electrician.*

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. VI.

(Continued from page 87.)

DUMPING-SCOWS.

FOR dumping stone in rough masses for foundations of sea-walls, etc., in harbor work, or for dumping waste material or refuse from cities, etc., a well-devised dumping-scow will save a large amount of labor in handling the designs for material. We propose to describe and illustrate some of the latest designs for this purpose.

In the work of improvement being carried on by the U. S. Engineer Corps in the Harbor of Newburyport, it was estimated that some 170,000 tons of material would have to be deposited below water to form the base of the dike and jetties which are proposed at the entrance of the harbor. The estimated cost of the whole improvement is some $375,000, and the estimate for the base or core work of the jetties amounts to $225,000. The contractor, Mr. C. H. Edwards, for a large portion of this work has devised a self-dumping scow which he used with success in depositing some 30,000 tons of rubble-stone (see Figs. 21 to 23). This scow is of the platform type—that is, the load is all on the deck, out of the water. Substantially it consists of a platform covering a portion of the main part of the scow on which it rests by means of cast-iron rollers set in a frame.

The scow itself measures 65x21 feet by some 6 feet of depth; the platform measures 32x21 feet, and its capacity is about 75 tons.

On the deck of the scow are eight inclined ways formed of timber 6x7 inches laid across the scow, with an inclination of 9 inches in 21 feet, on which are spiked the rails, which are of flat iron 3x½ inches.

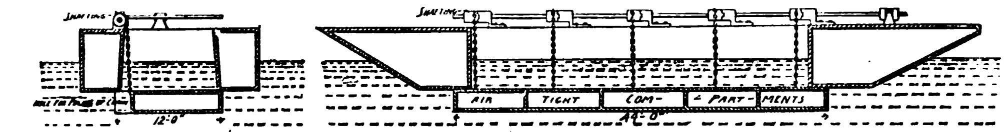
Live cast-iron rollers 5 inches wide and 4 inches thick, with 1-inch flanges ½-inch deep, are placed between strips of wood into which their axles are sunk, wooden keys holding the strip in place, the pairs being bolted together, with distance-piece between, so as to make a framework reaching the full width of the platform. On the under side of the platform are also eight pieces of 6x7-inch timber, with a 3x½-inch iron rail which bears on the top of the rollers. The flooring of the platform is spiked to these timbers. At each end, on the upper side, there is an iron band (*c*) passing loosely around the 6x7-inch timber of the inclined way, and made fast to the corresponding timber of the platform; this is the only connection of the platform to the scow. The upper surface of the platform is protected by cross-bars of iron 16 inches on centres, on which the stones can slide; these are kept greased to facilitate the movement of the stone.

To keep the platform in place there are on the under side three blocks (*t*), one in the middle and one at each end, against which press the ends of three shore-spurs (*s*), which are secured by a bolt (*d*), on which they can turn, to the deck of the scow. By means of a lever and a connecting-rod the three shore-spurs can be drawn aside, and the platform being released rolls down the incline till it projects some inches beyond the side of the scow, when it is suddenly stopped by three sets of buffers (*b*), also on the under side. The concussion and the tipping of the scow starts the load of stone which slides over the side, at the same time tipping the scow. As the scow rights itself after discharging the load it careens in the opposite direction, causing the platform to roll back into place, when by a quick movement the man at the lever replaces the shore-spur and secures it. In case it is necessary a tackle is used to draw the platform back to place. The operation of dumping occupies about ten seconds. The lever for moving the shore-spurs is six feet long to fulcrum, and 7½ inches from fulcrum to connecting-rod, so that a slight effort only is needed to draw away the shore-spurs.

This scow has done good service, but it has several disadvantages. The load is thrown out somewhat at random, being slid over the side. The crew is submitted to all the extra roll due to the unloading and the concussion, and extra precautions are necessary on that account. If the bank caused by the filling has reached nearly to water-line, there is liability of the scow striking, as the side sinks under the sliding load.

On the work at Sandy Bay, Rockport, Mass., a different class of dumping-scow has been devised. This was designed by Mr. Scripture (see Figs. 24 to 28). It belongs to the class of scows dumping from the bottom, in which the load is carried below the water-line.

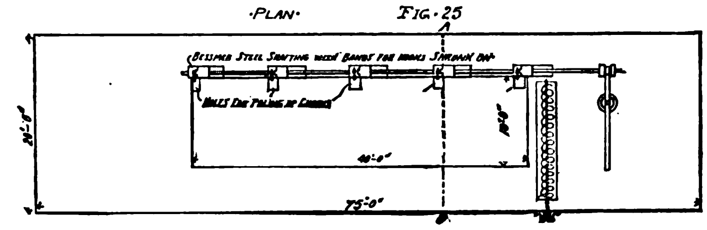
The scow used at Rockport measures 75x20x7 feet deep, in the centre of which is an opening 40x10 feet, with a flare of 6 inches on the sides, giving 40x11 feet opening through the bottom. Across this lower opening is a door 44x12 feet, 2 feet 7 inches deep, built with air-chambers, and capable of supporting a load of 25 tons. This is connected to the scow by eight large hinges along one side, and on the other side it is held up by five chains. These chains are about 9 feet long. They are brought up inside the scow, and passed over a set of steel hooks on bands that are shrunk on a line of Bessemer steel shafting. This shafting is 40 feet long, 3½ inches diameter at each end, increasing to 4½ inches in the middle. It sits in bearings along the side of the deck, and is turned by means of a ratchet and lever, connected by a knuckle-joint operated by a cam. The chains being passed over the hooks, the whole shaft is turned so as to bring the hooks over and hold the chains; the knuckle-jointed lever then holds them in place, and prevents the bottom from dropping down. The scow being loaded, and brought over the place where the materials are to be dumped, an effort of 30 pounds applied to the cam will raise the knuckle-joints sufficiently to release the ratchet, and the chains will fall off the hooks, and the bottom will drop back; at the



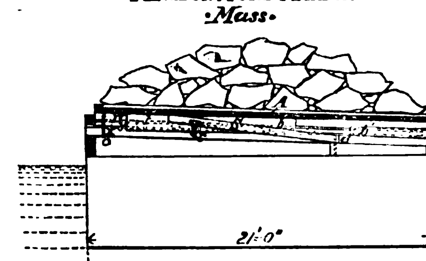
·SECTION ON LINE A-B· FIG·26 ·LONGITUDINAL SECTION· FIG·24

DUMPING SCOW USED AT SANDY BAY ROCKPORT·MASS· (The Sanitary Engineer & Construction Record)

·PLAN· FIG·25

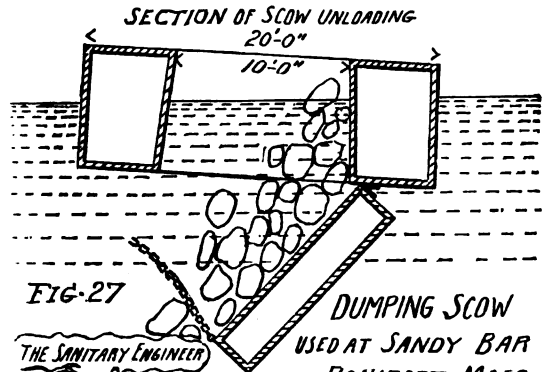


SELF DUMPING SCOW USED IN BUILDING JETTY CORES · NEWBURYPORT HARBOR ·MASS·

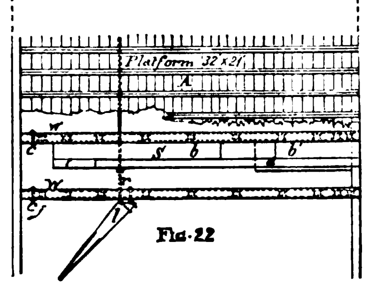


FIG·21

SECTION OF SCOW UNLOADING

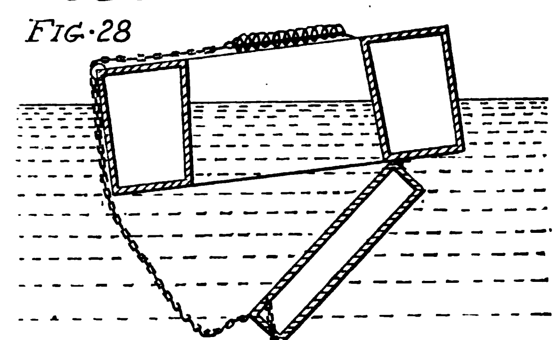


FIG·27 DUMPING SCOW USED AT SANDY BAR ·ROCKPORT·MASS· (THE SANITARY ENGINEER & CONSTRUCTION RECORD)

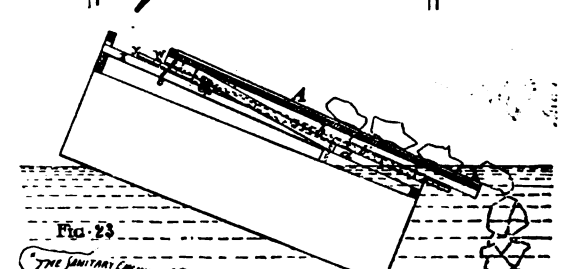


FIG·22

FIG·28



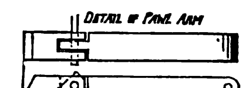
SECTION OF SCOW UNLOADED SHOWING CHAIN AND SPRING-ATTACHMENT·



FIG·23 (THE SANITARY ENGINEER & CONSTRUCTION RECORD)

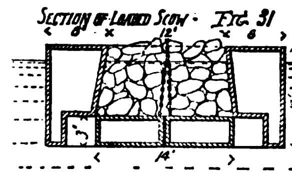
ROGERS' DUMPING SCOW ·ROCKPORT·MASS· (The Sanitary Engineer & Construction Record)

DETAIL OF PAWL ARM

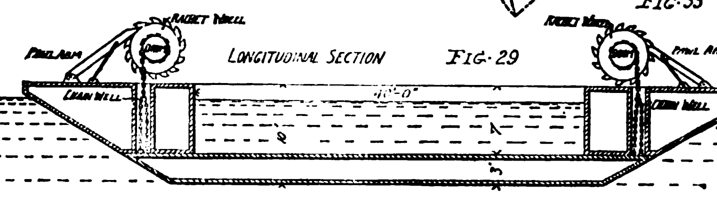


FIG·33

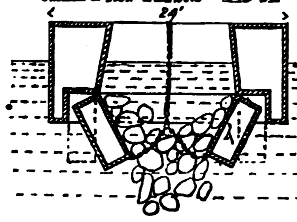
SECTION OF LOADED SCOW· FIG. 31



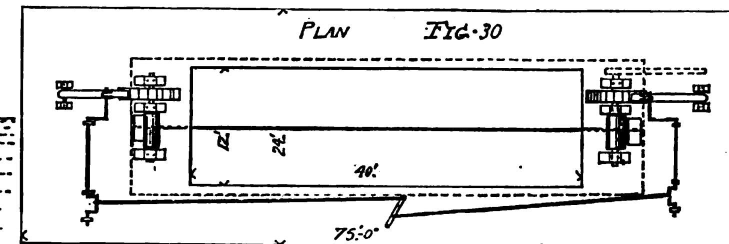
LONGITUDINAL SECTION FIG·29



SECTION OF SCOW UNLOADING· FIG·32



PLAN FIG·30



same time the side of the scow will rise in the water, being relieved of its load, which slides off of the bottom. The sides of the well are protected by strap-irons 4x½-inch to 4x¼-inch, placed vertically 12 to 15 inches apart, against which all the friction comes.

Figures 24 to 26 show the tripping arrangement to be a series of clutches which can be disengaged by a forked lever, instead of the ratchet and jointed pawl described above. The pawl is similar to that shown in Figs. 29, 30, 33.

As first designed, as the load was discharged the bottom would open wide on its hinges, and pass *beyond* a vertical line, in which position its buoyancy operated as a hindrance to its closure, causing much difficulty in bringing it back to place. To obviate this there was placed on each end of the deck a box containing six car-springs with ⅞-inch rods, to which chains were attached. These were brought over the side of the scow, and made fast to the edge of the bottom. By this arrangement, when the bottom is dropped, the chains are drawn out, and the springs being compressed prevent a sudden concussion. The chains are regulated so as to give to the bottom an opening of about 70 degrees. By this means, after the load is discharged, the buoyancy of the bottom causes it to return to its place. The chains are then drawn up through openings in the bottom by means of pole-hooks, and hooked into place again. This scow can be dumped and made ready for another load in five minutes by the help of but two men.

The total depth with bottom is 9 feet 7 inches. The draught is from 8 to 8½ feet with a load of 160 tons. But this amount is found to give considerable strain to the scow in rough weather, and it is frequently reduced to 100 tons. The average load is from 125 to 130 tons. During the last eight months, 40,000 tons of rock have been deposited with this apparatus.

There is, however, one defect that is only partially overcome by it. The load, as on the Edwards scow, is shot off sideways and has not a direct vertical fall. Also, during the unloading the bottom projects down some eleven or twelve feet below the surface of the water, though this, of course, diminishes as the load goes out. The hands on the scow are also submitted to the lurch of the scow when it is dropping its load.

At the present time Mr. James Rogers is getting out a design for an improvement as shown in Figs. 29 to 33. In the Rogers scow the bottom opens in the middle and is hinged on either side, so the material is dropped vertically from the bottom. The total depth of the scow is about the same, but it is arranged so that the flaps of the bottom open within the outside lines of the scow.

This scow is designed to carry 200 tons. On deck it measures 75x24 feet, and is 10 feet deep, with a well 12x40 on the deck, 14x40 on the bottom. Each half of the door measures 7x40x3 feet. They are held in place by means of chains fastened to each end and drawn up through well-holes on drums located at each end of the deck. Each drum has a large ratchet-wheel having a knuckle-jointed pawl, Figs. 29, 30, 33, both of which can be tripped simultaneously by means of the bell-crank levers and rods shown. A slight effort will raise the knuckle one-eighth of an inch off the line of thrust, and this will suffice to release the ratchets. The chains do not leave the drums. Each drum-chain connects to the middle of a chain which runs from one flap to the other at each end, and as it is drawn up brings a big purchase on the flaps.

The well-hole will also be lined with vertical iron bands 4x½ inches on sides, and 4x¾ inches on end to receive the friction from the sliding rock.

This scow is expected to give very fine results. It will be built of 4-inch plank, with inside frame-work. As seen in section (Figs. 31, 32), during the dumping the flaps are entirely protected by the sides and ends of the scow. The only motion due to dumping will be a gradual rise of the whole scow as the chains are released.

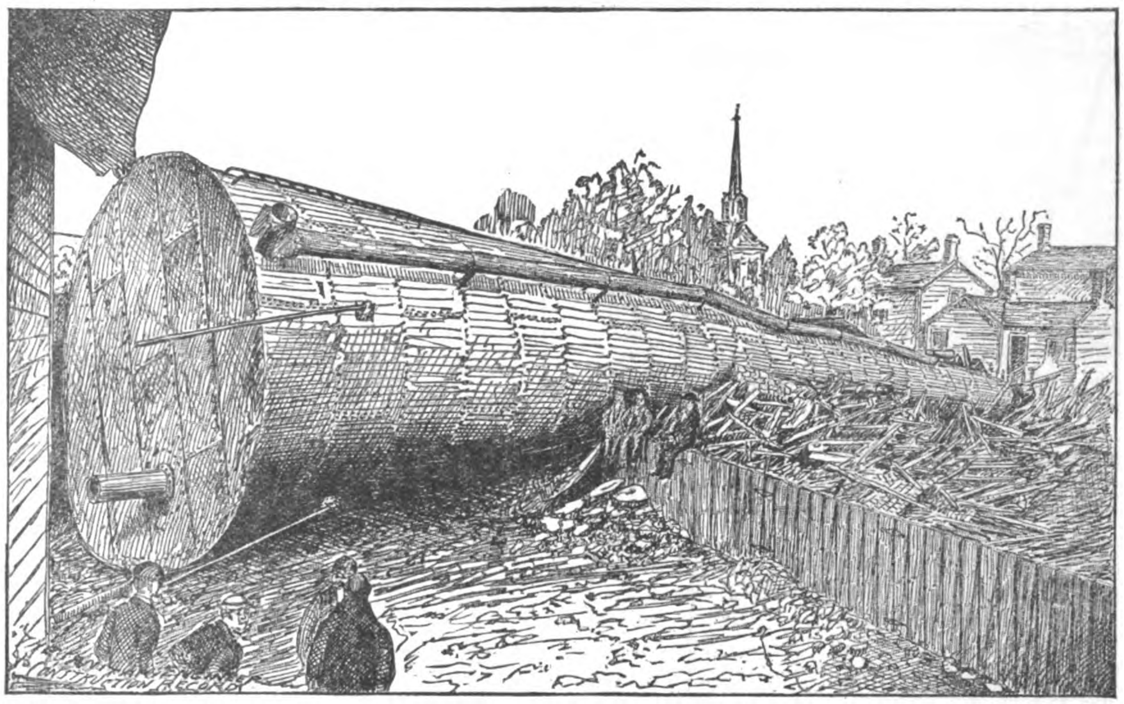
For all this kind of work very strong and tough material has to be used, as such scows are taken out in any weather in which a tug can live, and are submitted to enormous strains.

The work at Sandy Bay, Rockport, Mass., was first surveyed by Gen. George Thom ; then for a couple of years was in charge of Major C. W. Raymond, and at present is in charge of Col. G. L. Gillespie, all of the U. S. Engineer Corps.

(To be continued.)

FALL OF THE WATER-TOWER AT KANKAKEE, ILL.

An article on this subject was printed in The Sanitary Engineer and Construction Record of October 30. We are now indebted to Mr. J. S. Wilson, of Chicago, for the receipt of a photograph and further information, from which the following article has been prepared. The tower was erected by the Sharon Boiler-Works, of Sharon, Pa., for Hinds, Moffett & Co., of Watertown, N. Y., in connection with a water-supply system furnished by the company last named, who have entered into a contract to supply the city with water for twenty years at a fixed price per annum, after which the works are to be taken over by appraisal. The accident happened before it was filled with water, which would have added to its stability. The tower was cylindrical, of 20 feet diameter, 124 feet high, made up of rings 4 feet in height, with a double row of staggered rivets in the vertical seams, and a single row in horizontal seams. The first ring was $\frac{11}{16}$-inch thick, then three ⅝-inch, three $\frac{9}{16}$-inch, three ½-inch, three $\frac{7}{16}$-inch, and three ⅜-inch, all riveted with ¾-inch rivets. The next three were $\frac{5}{16}$-inch thick, then three of ¼-inch, all riveted with ⅝-inch rivets. There were then three of $\frac{5}{16}$-inch iron, with ⅜-inch rivets, and six rings of ⅛-inch iron, with $\frac{5}{16}$-inch rivets. At the top edge was a 3x3x½-inch angle-iron, and the bottom was attached to the lower ring by an inner and outer ring of 6x6x¾-inch angle-iron, with ⅞-inch rivets. The only stays were six 1½-inch diameter rods attached to cast-iron lugs at the centre of the second ring (about 6 feet) from the bottom on the outside, as seen in the engraving. The lugs were each riveted on by six ⅞-inch rivets. The masonry of the foundation was 21 feet in diameter, and the ties extended 2 feet into it, and then latterly 2 feet for an anchorage. An iron ladder was attached to the exterior for access, and an overflow-pipe 14 inches in diameter, seen in the engraving, extended to near the top.



The wind at the time of failure is estimated to have had a force of eighteen pounds per square foot. Our informant asks : "What would be the tensile stress on the plates at the base of the tower, and whether any account should be made of the weight of the tank resting on the first course ?"

In reply we may assume that the maximum depth to which the tower would be filled is 120 feet, which would give a pressure at the bottom of 52 pounds per square inch, and the diameter being 20 feet a strain of 12,480 pounds on the two sides for an inch of height, or 6,240 pounds on eleven-sixteenths of a square inch of metal, this being equal to 9,077 pounds per inch of section and tending to break apart the vertical joint. As about one-third of the metal is cut out by the rivet holes the actual strain would be 13,615 pounds. This is between one-third and one-fourth of the strength of good iron, and would certainly not rupture the iron.

The pressure at the base due to the weight of the shell is but about 150 pounds per inch of circumference. Of course, it brings a strain on the circumferential rivets, but it is too slight to be of moment.

The pressure from the wind is that on an area equal to the central vertical section, or that on 2,480 square feet. If we take the rule found by experiment that the pressure on the cylindrical surface is one-half of what it would be on a flat plate of the size of the section, then we have 9 pounds per square foot, or a total wind pressure of 22,320 pounds. The centre of pressure being at one-half the height, or 62 feet, gives an overturning moment of 1,383,840 foot pounds.

The shell weighs about 120,000 pounds, with its centre of gravity at the central point, and the lever-arm to resist overturning may be taken at 7 feet, giving an extreme moment of resistance of 840,000 pounds, leaving 544,000 foot pounds to be resisted by the stays. The three of these to windward would act to resist rotation around the same point, with a lever-arm of about 14 feet, and give an average strain of about 39,000 pounds on the three, or 13,000 pounds each. As they have a section of 1¾ square inches of metal, this gives about 7,500 pounds per square inch. The shearing strain on the rivets is a perfectly safe one, as was shown also by their remaining intact.

We have to look further, therefore, for the cause of this failure. One of the first is the increased pressure due to the collapse of the upper thirty feet of the tube, as described in our first article, at once more than doubling the resultant pressure on this portion. The collapse might have been prevented by cross-stays, but the practice of making any plate which (in important work) is subject to oxidation so thin as ⅛-inch is unsound ; ¼-inch is the least desirable thickness. Even the $\frac{5}{16}$-inch plates withstood the force of the gale in this case ; but in the case of the tower at Victoria, Texas, $\frac{5}{16}$-inch plates failed in like manner. (See The Sanitary Engineer and Construction Record of November 27, 1886.)

The weakest point, however, was the anchorage. A strain of 7,500 pounds (assuming this to be correct) would require 50 cubic feet of masonry to bear the strain, which is much beyond what can be considered as acting to resist. But the previous account says the rods were broken off. The action would seem, therefore, to have been a gradual loosening of the mortar about the rods by the oscillations of the tower, thus bringing a powerful bending strain first in one direction and then in the other upon the stays at the right-angled bend mentioned. This would soon cause rupture and allow the tower to fall. This method of staying is bad in any case, and permanent guys near the top should be substituted. Had the tower been filled with water, there can be little doubt it would have withstood the gale ; but no structure should depend for stability upon a condition which is liable to fail. The tower even if filled with water would be subject to trying oscillations in the absence of guys near the top.

We have gone at length into this disussion, since it is very desirable that the public mind be educated to the idea that rule-of-thumb methods and temporary make-shifts are never economical, and it always pays to have sound engineering advice.

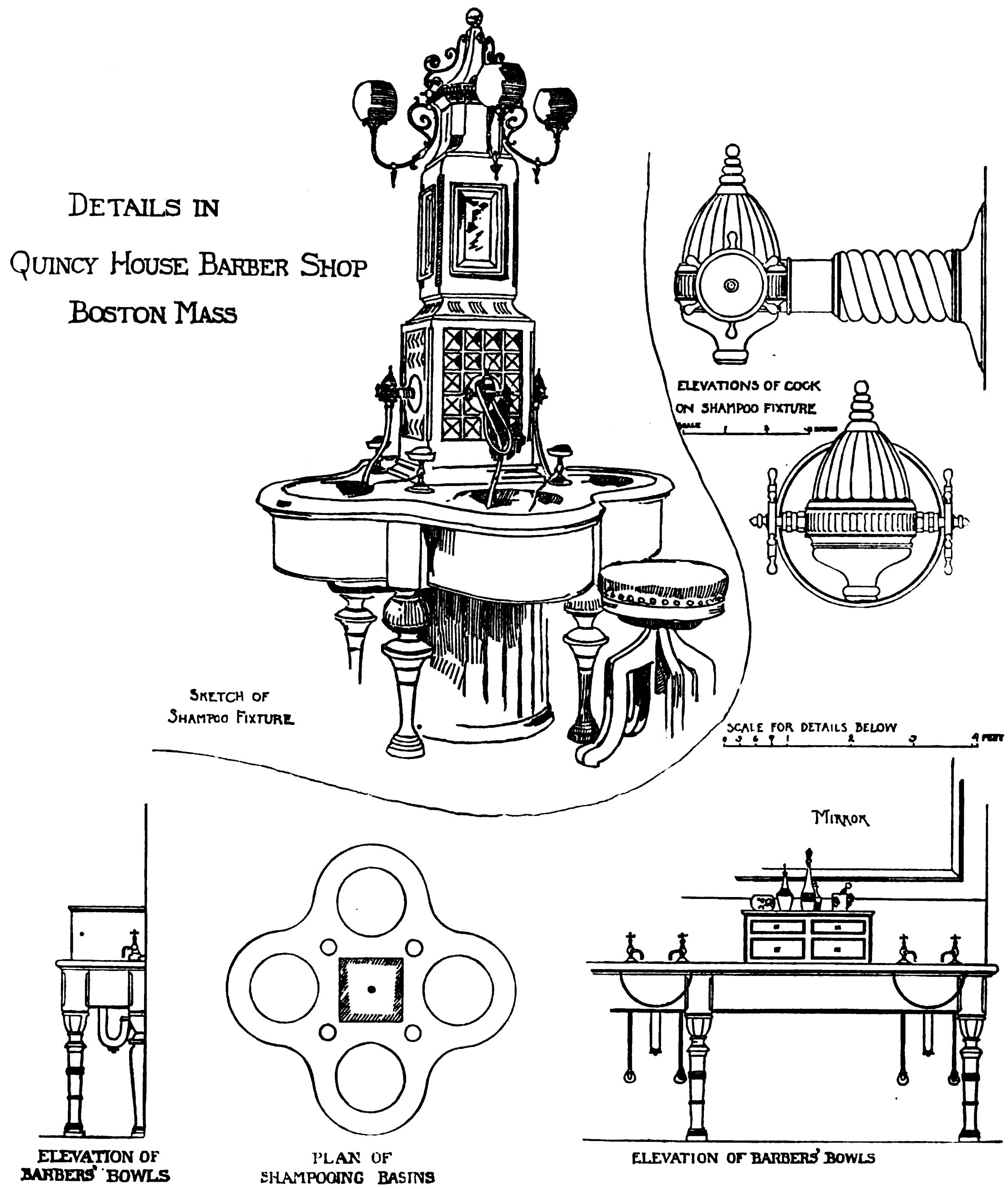
DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

OUR ILLUSTRATION OF A BARBER'S SHOP IN BOSTON.

THE subject of our plumbing illustration is the barber shop in the Quincy House, Boston. This room is very elaborate in its appointments. The floor is of black and white marble. The walls for 3 feet 6 inches high are covered with paneled white marble, finely polished; above the marble the walls are covered with mirrors. The ceiling is covered by mirrors and stained and ornamental glass set in lead frames. The chandeliers are of special design, with a one-light fixture, which hangs in front of each chair. About three feet from the floor in front of each chair a marble slab sixteen inches wide is continued quite round the room; it rests on turned and fluted polished marble legs. In this slab a small individual basin is set a little to the right of each chair supplied by hot and cold water. The supplies and traps are of polished brass. These pipes and traps are in full view, and in a few moments can be uncoupled in case of accident. The pipes have brass plates where they pass through the marble. Back air-vents are on the other side of the wall.

In the middle of the room are four large basins set in one white marble slab which rests on four legs, with brass supply and traps, the same as the individual bowls. These basins are for shampooing purposes only. The supply-cocks for this fixture are from a special design. It is claimed that the hot and cold water can be readily regulated to the desired temperature without causing the customer the usual annoyance of changes from hot to cold unless great care is observed by the workman. The difficulty of ventilating the traps of the shampooing fixture was overcome by using a 2-inch wrought-iron pipe which passes from the traps through the centre of the fixture and through the ceiling. This pipe has inside of it a small gas-pipe which lights the fixtures by four brackets.

The architect was Mr. Samuel J. F. Thayer, and the plumbers were Messrs. Tucker & Titus, all of Boston.



Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith, and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

THE ST. PAUL ICE PALACE AND WINTER CARNIVAL.

(From our Special Correspondent.)

ST. PAUL, December 11, 1886.

IT was the privilege of your correspondent to see, some days ago, a photograph of the ice palace which is to be erected in St. Paul for the carnival beginning January 17. The plans have just been submitted to the public, having been held back some time in order that the association could secure a monopoly of the same for its advertising purposes. Teltz & Joy, of this city, were the successful architects in the competitive contest for the plans, two hundred dollars being the prize offered for the best plans submitted, St. Paul architects alone being allowed to compete. The building to be erected this season will be 217 feet long by 194 feet wide, having an area surface of 42,000 square feet. The general form is that of a Latin cross, with a central octagonal tower 50 feet in diameter and 101 feet high. From the outer angles of this tower there are radiating and flying buttresses projecting 16 feet from the body of the tower. These are "stepped back" at the height of 55 feet from the ground, and terminate in small flanking turrets carried up three feet above the body of the tower. The turret at the south-east angle of the tower is somewhat larger than the others and is carried up 14 feet above the main tower, and is surmounted by a flag-post 20 feet high. The body of the tower is girt by belt-courses of projecting rock ice at 28, 43, 62, and 80 feet from the ground. Between these belts there are small windows. There is no roof. The walls of the tower and of the whole building will be built of solid blocks of ice twelve to eighteen inches thick, and from two to six feet in length. At the base of the tower the walls are five feet thick. The tower stands in a court, formed by a wall pierced with narrow, elongated windows. This wall is treated similarly to the tower, having a cornice and battlement. At each of the angles formed by the walls of this square enclosure there are circular and square turrets of different designs corniced and battlemented. From the four sides of the square spring the arms of the cross, the entrance at each of the terminals of these arms being a double arch six feet wide, flanked by a square base tapering into a circular turret forty-seven feet high and seven feet in diameter. The foot of the wall, and the whole building in fact, will be relieved and strengthened by stone buttresses. The foot of the cross extending in front of the building and toward the west is also a continuation of the main wall, and swells into a circle of majestic proportions, 95 feet in diameter. The entrance proper is an archway sixteen feet wide and fifteen feet high. The arch is composed of several courses of ice, alternately projecting and receding.

The wall at either side of the arch tapers off into graceful buttresses, and is surmounted by a pedestal, upon which is a colossal statue of King Borealis seated and supported on either hand by a polar bear rampant holding a colored electric-light. There are also two bears couchant on pedestals at each side of the entrance on the ground. All of these figures are carved in solid ice. King Borealis if standing would be twenty feet high. The citizens of the city are taking an active interest in the scheme, and the great success of last year's carnival promises to be equaled or surpassed this year. The carnival scenes are very spirited and interesting, and many novel and original features are promised.

THICKNESS OF CAST-IRON WATER-PIPE.

HALBERGERHUTTE (Post und Bahnstation Brebach a. d. Saar), November 18, 1886.

SIR: As subscribers for many years to your valued journal, we now take the liberty of asking your favor in the following matter:

So far as is known to us, many large plans for water-works have been executed in America in which cast-iron pipes of 1,200mm. (47."4), 1,400mm. (55."2), and 1,500mm. (59."1) inner diameter have been employed. May we be permitted to ask with great interest what thickness of metal these pipes have had, and what maximum working pressure the same had to withstand? Through your extended acquaintance both with the manufacturers of such pipes and with the managers and chief engineers of these water-works it may not be difficult for you to furnish us these data, for which we already, in advance, offer you our best thanks for your trouble, and tender with pleasure our assistance in any reciprocal service.

We await eagerly your acceptable information, and sign ourselves, Most respectfully,

RUD. BOCKING & CO.

[We reproduce the following table from a card of the Warren Foundry and Machine Co., of Phillipsburg, N. J. Possibly some of our readers may have catalogues giving further data which they may be disposed to send to our correspondents.]

Table showing Thickness of Metal and Weight per Length for different sizes of pipe under various heads of water.

Size.	50 Feet Head.		100 Feet Head.		150 Feet Head.		200 Feet Head.		250 Feet Head.		300 Feet Head.	
	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.
2........	.294	63	.312	67½	.330	72	.348	76½	.366	81	.384	86
3........	.344	144	.353	149	.362	153	.371	157	.380	161	.390	166
4........	.361	197	.373	204	.385	211	.397	218	.409	226	.421	235
5........	.378	254	.393	265	.408	275	.423	286	.438	298	.453	309
6........	.393	315	.411	330	.429	345	.447	361	.465	377	.483	393
8........	.422	445	.450	475	.474	50-	.498	529	.522	557	.546	584
10........	.459	600	.489	641	.519	682	.549	723	.579	766	.609	808
12........	.491	768	.527	826	.563	885	.599	944	.635	1,004	.671	1,064
14........	.524	952	.566	1,031	.608	1,111	.650	1,191	.692	1,272	.734	1,352
16........	.580	1,215	.604	1,253	.652	1,360	.700	1,463	.748	1,568	.796	1,673
18........	.589	1,370	.643	1,500	.697	1,630	.751	1,761	.805	1,894	.859	2,026
20........	.622	1,603	.682	1,763	.742	1,924	.802	2,086	.862	2,248	.922	2,412
24........	.687	2,120	.759	2,349	.831	2,580	.903	2,811	.975	3,045	1.047	3,279
30........	.785	3,020	.875	3,376	.965	3,735	1.055	4,095	1.145	4,458	1.235	4,822
36........	.882	4.070	.990	4,581	1.098	5,096	1.206	5,613	1.314	6,133	1.4-2	6,656
42........	.980	5,265	1.106	5,958	1.232	6,657	1.358	7,360	1.484	8,070	1.610	8,804
48........	1.078	6,616	1.222	7,521	1.366	8,431	1.510	9,340	1.654	10,269	1.798	11,195

All pipe cast vertically in dry sand, in lengths of 12 feet, except the 2-inch, which are cast 9 feet long.

HOT-WATER HEATING IN A BARN.

CANANDAIGUA, N. Y., December 15, 1886.

SIR: The inclosed plan (Fig. 1) is an arrangement for heating a barn by warm water. The coil now marked No. 1 has seven pipes. We want to take three of them and

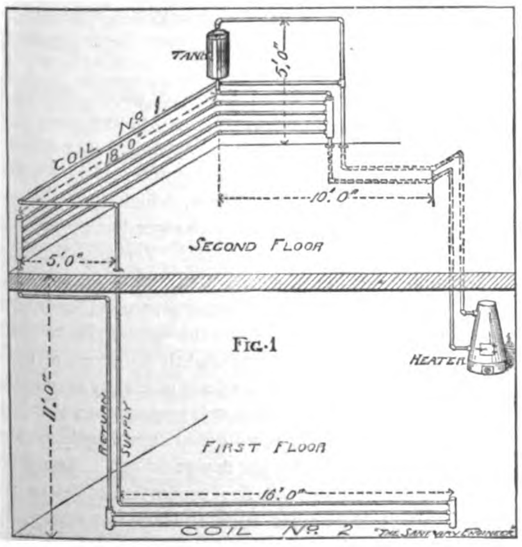


FIG. 1

place them in the stable on the first floor as shown, the same floor on which the heater is. The present arrangement is too much for upstairs, and we cannot place return pipe below the second floor, as it will freeze. The question is, will the circulation be good if the water first rises, then returns to within a foot or two of the bottom of the boiler, *then* has to go up *again* to *return* to be again heated? Please give us an answer that we may accomplish our object—the heating of the stable. The water at times is thrown over the sides of the tank. How may this be remedied?

I have seen a discussion in your paper, which is very valuable to me, about the connecting of boilers when hanging. I have hung a number and try to use the spuds already in them to the best advantage, as follows, always having good success. I have connected two boilers on this principle which work well, thus. H. L. H.

[The apparatus as you show it (Fig. 1) will not circulate. It is indispensably necessary that you carry the return pipe from the lower coil directly to the boiler without raising it above the lower manifold of the coil or without forming air-traps.

To accomplish this the return pipe may be carried below the first floor as shown by our diagram (Fig. 2), and if the coils are made of small pipe (1-inch) the whole apparatus

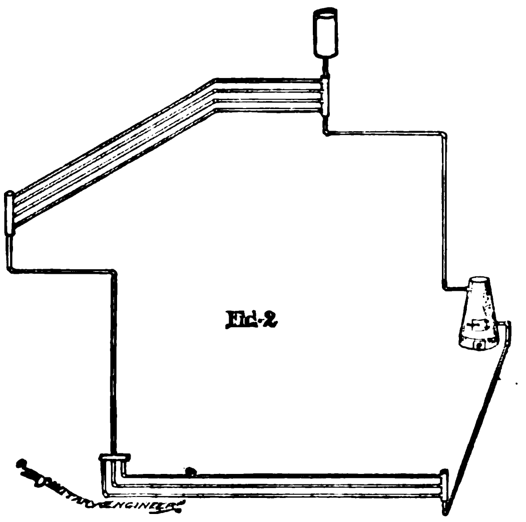


FIG. 2

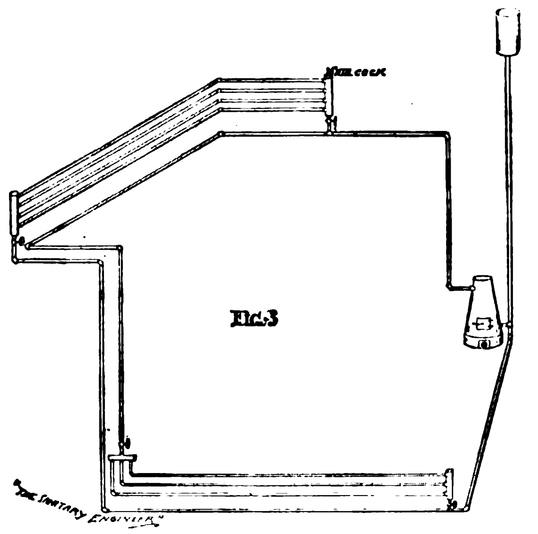
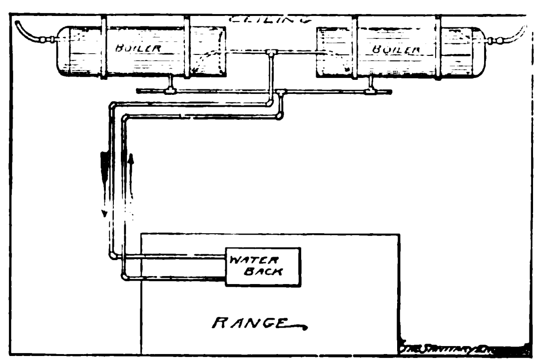


FIG. 3

can be arranged as we show it. If 3 or 4-inch pipe is used, the lower coil may be arranged with return bends instead of manifolds, and the mitre avoided. If each coil must be capable of being shut off separately, then you must arrange it as shown in Fig. 3. The two coils mus never be closed at the same time if the fire is lighted otherwise the water will flow out of the tank.



The reason the water is thrown over the sides of the tank now is because there is either no circulation, or because the boiler is too great for the work it has to do.

The return pipe can be run either in the floor or below it and covered against freezing; or, if the latter cannot be prevented, salt may be added until a brine is obtained that will not freeze.]

USES AND DURABILITY OF WROUGHT-IRON PIPE.

NEW YORK, November 16, 1886.

SIR: Can you refer me to any report giving a concise record of facts regarding the action of wrought-iron pipe in the various uses to which it is put? I have searched my copies of your journal from Vol. IV. to date, and find only meagre and conflicting data on which to base an opinion. If the following questionary could be circulated among engineers, architects, and plumbers, reliable and valuable information could be gathered:

1. Use to which pipe was put—gas, water, steam, sewage, and house-drains.
2. Sizes of pipe used and thickness of same.
3. Was pipe drawn or lap-welded, and note manufacturer and process, and describe the same.
4. Was it coated with a preservant, and if so what, and how prepared.
5. How long in use.
6. Give average life of pipes which you have employed.
7. How situated—exposed, buried in earth or cement, lime, packed, etc.
8. Was it in contact with other metal, etc.
9. If corroded, how long in use. Did corrosion take place from within or without.
10. Was any peculiarity noticeable in the molecular structure or fibre of broken piece taken out.
11. Describe minutely corroded portions, size and shape of holes, whether ragged at edges or smooth, etc.
12. General remarks.

Very truly yours, W.

[We do not know of any publication in which the detailed information asked for can be found. The "Transactions of the New England Water-Works Association for 1884" contained replies from the superintendents of thirty-nine water-works relative to their experience with wrought-iron service-pipes for water, and also a paper on service-pipes by Mr. W. H. Richards, of New London, Conn. Some valuable data may be found in this paper and the brief discussion had upon it. Copies of the pamphlet may possibly be obtained from Mr. Albert S. Glover, Newton, Mass., the secretary of the association.

To circulate the questions proposed by our correspondent and to follow up the correspondence necessary to elicit valuable information from the replies which would be received, and then to digest that information and make it intelligible and intelligent, would require at least a year's time and an expenditure of twenty-five hundred dollars, according to the estimate of an expert in the matter of compiling technical information by correspondence of this kind. Including the cost of publication, we should say that no one would be justified in undertaking such a task unless he could be assured of a return from sales and advertisements of at least four thousand dollars, and very probably more.]

VALVES FOR STEAM-COILS WANTED.

PERCY IRON-WORKS, NEWCASTLE-ON-TYNE, December 13, 1886.

SIR: Can you give us address of makers of self-acting valves for steam-coils to close by pressure and expansion? We would like drawings and prices.

Yours faithfully,

DINNING & COOKE.

[Our correspondent doubtless refers to what we call automatic air-valves. A number of our advertisers make them, and will doubtless furnish the information desired.]

WASTE OF WATER IN MILWAUKEE.

(From our Special Correspondent.)

FROM December 1 to 4 the weather was very cold and the waste of water in Milwaukee was enormous. There are but few water-meters here, but their use ought to be general. It would pay the city to furnish them to consumers at less than cost. On Third Street nearly every store building has flats above, and to keep the water from freezing it is allowed to run all night on cold nights.

The plumbers can put in stop-cocks to shut off the water, but they do not know of a way of keeping traps from freezing on the second and third floors of these cold flats over stores, where the people have their stoves in the rooms. One landlady told a plumber last week that it was the tenant's fault that the water-pipes were frozen, as the occupant had been instructed to let the water run in cold weather. The system of night inspection in vogue here is a good one, but more could be done to stop the terrible waste of water if there was a plumbing inspector to look after it.

[This evil cannot be checked until the authorities control the location of plumbing-work in buildings. No plumbing should be allowed in portions of buildings that are not protected from the cold.—ED.]

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

NEW DAMPER-REGULATOR.

THE accompanying cut illustrates a novel form of damper-regulator for use in connection with steam-boilers. It is called the Flinn Mercurial Damper-Regulator; the novel points of which are the interposition of mercury between the steam and the moving parts of the regulator proper, and the means of overcoming and almost nullifying friction of the axis of a balanced damper.

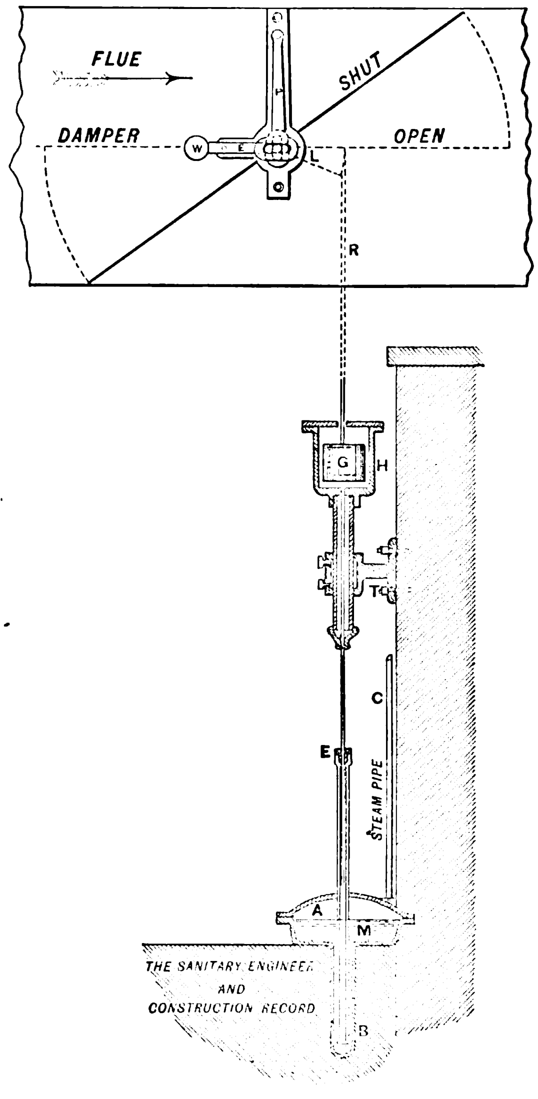
The lower part of the illustration shows the regulator in section and the upper part a damper suspended on a smoke-flue, the axis being in cross section, and its means of support and anti-friction gear in elevation; the damper, the lever, and the connecting rods being dotted in to show the relation between the principal parts.

The regulator proper consists of a cast-iron receptacle A, which is filled with mercury about as shown, and holding a sufficient quantity that when displaced by pressure from the chamber A it will fill the chamber H, or rather that part of the chamber not already occupied by the float G, without overflowing the former. The float G is free to rise and fall with the mercury in the chamber H, and the rod which projects from its top connects with the damper. The boiler-pressure enters the chamber A through the pipe C marked steam-pipe, but which in reality is filled with condensed water, condensation taking place as soon as steam first comes over, forming a water layer on the mercury and filling the pipe, which prevents oxidation of the mercury. The pressure of the steam, therefore, from the boiler through the pipe C, raises the mercury in a column until it reaches the upper chamber, when it closes the damper by elevating the cast-iron float G. When the pressure begins to fall the float G acts as a weight, drawing the damper open.

The extension B on the bottom of the chamber A is to prevent an overflow of mercury about the unpacked spindle of G. As the steam-pressure approaches the maximum it at first only raises a column of mercury in the small tube, making only a small difference of level in the chamber A, but rapidly increasing the static head in the small tube. When the mercury reaches H there is a more sudden depression then of the mercury in A, as the chamber H can receive it with a slight increase of static head between the level of the mercury in both chambers. This gives the necessary movement to close the damper. Should the pressure then continue to increase slightly after the damper is closed, the volume of mercury in the extension B, which is about thirty-six inches long, is inconsiderable as compared to the capacity of G, that ten pounds extra pressure is not sufficient to overflow the latter, the static head being increased not by the rising in G so much as by the lowering in B.

The apparatus is set by measurement and adjusted by sliding the small tube within the gland at E, the head being adjustable in the bracket T. About thirty inches of mercury is required for each atmosphere of pressure (fifteen pounds) carried on the boiler, and the tube is made sufficiently larger to compensate for temperature of location.

The friction on the damper axis is reduced to a minimum by the latter's rolling in the link P, which is suspended from the point F on a knife edge or small stud. The plane of the link on which the axis rolls is an arch of a circle whose radius is the knife edge or stud. As the axis revolves the tendency would be to travel on the link, but a somewhat



similar link is interposed on the bar E, pivoted as shown, with a counter-weight W, of just sufficient weight to keep the bottom of the link against the axis. When the axis revolves in either direction, it is met by this secondary link and is prevented from advancing, the pendulum link at the same time being drawn back, leaving the axis as it were to revolve on a level and straight plane, but that instead of the former going forward the latter goes backward, leaving the axis simply a rolling motion.

The apparatus is to be made and furnished by the Flinn Mercurial Regulator Company, 91 Chambers Street, New York.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
December 25....	25.99	20.39	20.08	30.63	30.08	23.27	31.34

E. G. LOVE, Ph.D., *Gas Examiner.*

THE municipality of Brussels has decided to reduce the price of gas after January 1 to fifteen cents per cubic metre (about eighty cents per 1,000 cubic feet).

ABOUT a year ago Mr. Dibdin, Chemist and Superintendent Gas Examiner to the Metropolitan Board of Works of London, obtained permission to have constructed a four-way photometer for the purpose of carrying out an elaborate series of experiments to determine which one of the many photometric standards proposed is the best. The object of the four-way photometer is to permit the examination of a single gas-flame by four different standards at the same time. The *Journal of Gas-Lighting* advises all persons having photometric standards to bring them out and submit them to examination at the hands of Mr. Dibdin. Whatever the outcome of these tests may be, it is natural to suppose that any possible change in the present standard which the Board of Works may suggest or urge will be based upon the results of Mr. Dibdin's experiments. It is to be hoped, however, that an opportunity will be offered the friends of the various standards to verify Mr. Dibdin's results by means of the board's photometric apparatus, and thus shut off to a great extent a long and bitter discussion which otherwise would certainly follow a decision favoring any particular standard.

A Mr. W. M. Mordey reports experiments with electric lamps for use in coal-mines. For the purpose of his experiments, he took an ordinary box containing an incandescent lamp, loading up the box with coal-gas. He then made a small hole at the end of the lamp, but no explosion resulted with the destruction of the vacuum. The breaking of the lamp under similar conditions was also satisfactory, the breaking of the filament and the destruction of the vacuum being simultaneous. By breaking the globe only, however, without touching the filament, an explosion occurred. The introduction of one incandescent lamp into a larger one, and sealing the space between with water, gave satisfactory results. Neither by breaking the globe nor by smashing the lamp altogether did the experimenter obtain an explosion. In view of the number of accidents that are continually reported from mines, resulting either from carelessness or misadventure on the part of the miners, in connection with their lamps, it is to be hoped that the experiments will be continued.

THE HEALTH OF SHEFFIELD, ENGLAND.

DR. SINCLAIR WHITE, the Medical Officer of Health, has published his first annual report, which relates to the vital statistics and sanitary condition of the borough of Sheffield for the year 1885. The borough of Sheffield includes an area of thirty square miles, a part of which is occupied by the town itself, the rest being thinly inhabited. The country is hilly and well adapted to drainage, and has four small streams passing through it. The population for the middle of the year 1885 is estimated at a little over 305,000. The birth-rate for the year was 35.1 per 1,000 of the population. Nearly 5 per cent. of the whole number of births were illegitimate. This is the lowest birth-rate for the borough which is on record. The highest birth-rate appears to have been reached in 1873, when it was 43.2, since which it has steadily diminished. The death-rate for the year was 20.6 per 1,000, which is lower than that of any previous year recorded. As usual, the proportion of deaths of illegitimate children is greater than of the legitimate, but, as Dr. White remarks, allowance must be made for the social difference between the two classes. The illegitimate children should be compared, not with all the children in the town, but with those resident in the poorest and most densely inhabited districts, where, in the greatest majority of cases, they are born and reared; and, when this latter comparison is made, it does not appear that the illegitimate children die in greater proportion than the legitimate.

A very elaborate series of tables is given, showing by streets the location of the deaths, and giving some of the principal causes. In regard to mortality in relation to trades, which is a matter of special interest in Sheffield, some interesting tables are given, which, however, only confirm what is already known with regard to the unhealthful influence of certain occupations. Very great improvement has evidently been made in the conditions of manufacture in certain trades; for instance, among the grinders, cutlers, and tool-makers, while the proportion of deaths from diseases of the lungs was slightly in excess of that of men in other occupations, the total mortality among these workmen was only one per 1,000 greater than that of all males in Sheffield. This, no doubt, has largely been due to the substitution of wet for dry grinding. Among file-makers there was an excessive proportion of deaths from consumption and diseases from the nervous system, due probably to chronic lead-poisoning. Few workmen in this trade attain the age of sixty-five years.

We hope that this report is the beginning of a long and valuable series, in which the sanitary conditions of artisans will receive careful study.

ENGINEERS' CLUB OF PHILADELPHIA.

AT the meeting of December 18, President Washington Jones in the chair, the secretary presented, for Mr. Kenneth Allen, a table of thicknesses of plates for stand-pipes, with formulæ, for the reference-book.

Prof. L. M. Haupt presented the results of some calculations upon the equilibrium and stability of his system of floating deflectors, showing how conveniently the pressure upon the bottom may be regulated and the currents automatically controlled by weighting the lower edge of the deflector. The angle at which the normal pressure is equal to the counterpoise was found to be 48° 12', and the natural sine of this being .745, if the shield were equal in length to the depth at this angle, it would reduce the sectional area of the prism of discharge 75 per cent., and hence increase the velocity fourfold.

If, from any external cause, the velocity should become greater than that due to the weight, it would raise the shield, and *vice versa*. Such conditions would occur in tidal waters.

The weights and displacements of the several parts of the lateral deflecting system by which the prism of discharge is further augmented, were also presented, showing that under ordinary conditions of maximum velocity of tidal water for New York Bay, there was a factor of fifteen in favor of the buoyancy.

References were also made to the safety and durability of similar screw-disk mooring under more severe strains, and the fact that the late severe storms on the Gulf coast have not injured the jetties at Sabine Pass or at South Pass was instanced as further evidence that the more destructive forces are at and above the surface.

The form and position of snow-drifts were cited to illustrate the effects of the action of movable fluid forces upon solids, and the phenomena observed by Mr. Rudolph Hering, as to the movements of the bottom currents in Lake Michigan being opposed to the direction of the wind, were alluded to as a confirmation of the general law of equilibrium.

The author further stated that a current deflector of much more limited application, which had been tried in France, showed an economy of 90 per cent. in the cost of dredging.

The Secretary presented, for Mr. A. H. Howland, a paper upon stand-pipes.

The general form, utility, and economy of stand-pipes and elevated tanks are discussed.

A formula for the thickness of plates is then presented; and the strength of riveted seams, the factor of safety, the reductions of thickness of plates toward top, etc., are discussed.

Tabular data, within practical limits, for thicknesses, dimensions, and capacities, are given; also method of obtaining weights. The use of the micrometer sheet-metal gauge for thicknesses is advocated.

Form of joints, method of calking, mode of setting, etc., are treated of, and the paper is concluded with a table of wind velocities and pressures.

The Secretary presented, for Mr. J. H. Harden, notes upon the Chester County, Pa., granite, illustrated by specimens and photographs.

"Chester County has become noted for its granite (syenite), and recently three separate companies have been organized for the development of quarries in Warwick Township, on the line of the St. Peter's Branch of the Wilmington and Northern R. R., forty miles direct and sixty miles by rail from Philadelphia."

"An examination of the county from Springfield on the north-western boundary of the county, to and beyond the Falls of French Creek, near Pughtown, a distance of more than six miles, discloses large boulders of syenite scattered over a wide extent of surface, culminating at certain points in boulders of huge dimensions, with the appearance of the solid 'ledge' (outcrop) from whence they were derived."

The author then describes the boulders which are now being quarried and cut up, many of which the photographs show to be very picturesque, and notes the various methods for getting out the stone.

"At any of these quarries there should be no diffiulty in obtaining the largest sized stone required for architectural purposes, equal to the old-established quarries."

"Regarding the quality of this granite, Dr. Charles M. Cresson, who has examined and reported (No. 4,740) thereon, says as follows:

'The samples of this granite consisted of a number of specimens of rough, undressed stone, and of a bar, and of several cubes for ascertaining the resistance of the stone to crushing strains, also of a specimen of polished stone.'

'This stone is a syenite of fine and even texture, the component quartz being less in amount and in much smaller masses than in the Quincy granite.

'The so-called Quincy granite (with which I have been directed to compare the French Creek stone) is also a syenite. I find that the Quincy granite weighs about 167 pounds, and the French Creek about 191 pounds to the cubic foot.

'In the "New American Cyclopædia" (Appleton) it is stated that there is a granite on Staten Island which has been largely used in New York for paving, which is remarkable for its extreme density, a cubic foot weighing over 180 pounds. This difference would give the Staten Island rock a decided advantage in the construction of submarine works like breakwaters, requiring great stability.'

'From this statement it is evident, therefore, so far as weight is concerned, the French Creek stone has an advantage over the superior Staten Island stone for submarine works.'

'In consequence of the finer grain of the French Creek stone in addition to greater density, it also possesses greater toughness and resistance to wear than the Quincy stone, and experimental trials confirm this opinion.'

'Mr. John C. Trautwine, in his tables on the strength of materials, gives the ultimate average crushing load for granites and syenites at 300 to 1,200 tons per square foot. Trials upon somewhat imperfectly prepared cubes of the French Creek stone showed that a force of over 23,700 pounds on each square inch, or over 1,500 tons on each square foot, was necessary to crush them. With cubes carefully prepared with parallel sides and plain surfaces a much greater force would have been required for the purpose.'

'Experimental trials, by chemical means, of the ability of this stone to resist atmospheric influences calculated to produce disintegration, show that the French Creek stone is at least fully equal to the Quincy granite in that respect.'

'In my opinion the French Creek stone is a tougher, stronger, and more durable stone than the Quincy granite, and better adapted for building or paving, or any other purposes to which the Quincy granite is applicable.'"

"No better evidence of the value of Chester County granite should be required."

"At all three quarries, and particularly at that of the French Creek Granite Company, there is a large quantity of waste stone that would make excellent material for macadamizing roads."

"While there are only three organized companies, there are yet many favorable locations for opening other quarries, and we should not be surprised to find Chester County supplying all the paving-blocks and a good part of the cut granite required in the city of Philadelphia and neighboring towns."

"These rocks (specimens shown), I have reason to believe, are not confined to Chester County. On the maps of the second geological survey of Pennsylvania they are designated 'traps,' and some practical men have denied the correctness of the term as applied to these rocks."

"Other samples, believed to have had the same origin but different in composition, accompany these notes."

C. SHALER SMITH.

A SPECIAL meeting of the Engineers' Club of St. Louis was called for Tuesday, December 21, by the President, to take action in regard to the death of Colonel C. Shaler Smith. The chair stated his reasons for calling the club together, announcing the death of Colonel C. Shaler Smith, and calling attention to his valuable services to the club and his high standing in the profession. He suggested some action on the part of the club appropriate to the occasion. On motion, the club decided that the chair appoint a committee of three to draft suitable resolutions to be presented at the next meeting of the club. Messrs. R. E. McMath, E. D. Meier, and J. B. Johnson were appointed such committee. The chair called upon members of the club for remarks. Colonel E. D. Meier spoke of the lovable character of the deceased, and the pleasure of intercourse with him, both in business and socially. His versatility of talent and his familiarity with all the branches of engineering were remarkable. His original experiments and research were of great value to the profession. Colonel Smith would be best remembered in St. Louis by his connection with the St. Louis Bridge and the St. Louis Exposition, the success of the machinery department being due to him. Colonel Meier related the accident which resulted in his death. Colonel H. C. Moore spoke briefly of the standing of the deceased in the profession.

H. P. Taussig, formerly an assistant to Colonel Smith, spoke briefly of his intercourse with him. Professor Potter mentioned a letter dictated by Colonel Smith very recently, which was full of cheerfulness. Professor Johnson spoke of the wonderful amount of work carried on by Colonel Smith. The training received by the young engineers in his employ would perpetuate his influence on the profession.

At the meeting of the club December 15 the election of the following officers was reported: President, Professor W. B. Potter; Vice-President, M. L. Holman; Librarian, Professor J. B. Johnson; Secretary, W. H. Bryan; Treasurer, Charles W. Melcher; Directors, R. E. McMath and William Wise. The following resolution was passed: "*Resolved*, That this club appoint a committee of five to consider the subject of a closer connection of existing societies, with a view to forming a general organization." The committee was appointed as follows: R. E. McMath, M. L. Holman, J. A. Seddon, Robert Moore, and William Bouton. The special order of the day, a paper by Professor F. E. Nipher, on the "Economic Coefficient of the Shunt Dynamo," was then taken up. The Professor gave a mathematical discussion of the theory of the efficiency of this class of machine, and showed the conditions under which a maximum was reached. The life and resistance of incandescent lamps was also touched upon. The subject was discussed by Messrs. Flad, Seddon, and Bryan. Professor Nipher also spoke briefly on the subject of discrepancies in measurements of rainfall in gauges at varying heights.

WE advise the Pennsylvania State Board of Health to change its so-called "official organ," and in the meantime to exercise some supervision over the method of touting for advertisements which is now being carried out by letters sent out in the official envelopes of the board.

THE POWER OF A TON OF COAL.

FEW of our readers know what a ton of coal will yield at the gas-works, while, burned in the usual pattern of domestic grates, the principal products are smoke and dust; the ammonia, the tar, etc, are completely lost. It will yield 10,000 cubic feet of gas, 1,500 lbs. of coke, 20 gallons of ammonia water (valuable manure), and 140 lbs. of tar. The tar, when destructively distilled, will yield in round numbers 69 lbs. of pitch, 17 lbs. of creosote, 14 lbs. of heavy oils, 6 lbs. of naphthaline, 4 lbs. of naphthol, 2 lbs. of naphtha, 2 lbs. of alizarin, and 1 lb. of aurine (valuable dyes), besides phenol (carbolic acid), benzol, aniline, tolmidine, anthracene, and tolicene (from which the new sweetened saccharin is made). This should hasten the general use of gas-stoves, and of coke where fires are absolutely necessary.

REPORT ON THE SOCIAL STATISTICS OF CITIES.*

THIS large and handsome volume, of 915 pages, with inserted maps, forms Vol. XVIII. of the reports of the tenth census, and contains descriptions and statistics of 104 cities and towns in the Eastern and Middle States. For each of these cities the data given include location, railroad communications, the tributary country, the topography usually with a map, climate, streets, water-works, gas, public buildings, public parks, places of amusement, drainage and sewerage, cemeteries, markets, sanitary authority or board of health, garbage disposal, municipal cleansing, police, fire department and public schools. A brief statement of the population at each of the decennial censuses and of the financial condition is also given. With regard to a number of the places an historical sketch is also given.

The reports on the several places are unequal in completeness, but every one contains interesting and valuable information, and the whole forms a standard book of reference which every library must possess, and which in the future will be of the greatest historical interest and value.

It is to be hoped that with the second volume, completing the work, Colonel Waring will give us something in the shape of a summary, indicating some of the conclusions from this survey, which he is so well qualified to draw.

WIRES IN CITIES.

AN Associated Press dispatch from St. Louis, says that Col. Flad, President of the Board of Public Improvements, suggests a solution of the telegraph and telephone wire trouble in cities. Col. Flad's plan calls for iron towers 100 to 150 feet in height at each second street intersection, the towers to consist of four wrought-iron columns; the base of each to be implanted at the corner of the sidewalks, these columns coming to a common centre in the middle of the street, to furnish a resting place for all telegraph, telephone, and electric-light wires. His plan also embraces provision for electric-lamps on the towers for street-lighting purposes, and provides wires by which to operate street-cars on the Siemens principle as employed in Berlin.

PERSONAL.

ASSISTANT ENGINEER FRANK W. BARTLETT, of the United States Navy Department, will take charge of the classes in mechanical engineering at the Orchard Lake Military Academy, Mich., under orders of the Secretary of the Navy, dated December 16.

MAJOR JARED A. SMITH, Corps of Engineers, has been ordered from Portland, Me., to Fort Knox, Me., on public business.

REAR-ADMIRAL WORDEN, U. S. N., was placed on the retired list of the Navy December 28, with the highest pay of that grade.

MR. E. B. DORSEY presented a paper on heavy steel guns before the United States Naval Institute at the Newport Torpedo Station, last Wednesday evening.

JAMES W. BROWN, architect, of Baton Rouge, La., died there December 24, aged seventy-six.

ASHBEL H. BARNEY, express and railroad manager, died in this city December 28, in the seventy-first year of his age.

LIEUT.-COL WILLIAM P. CRAIGHILL, U. S. Engineers, has been assigned to additional duty as member of the Board of Engineers for fortifications of the river and harbor works.

---

* Department of the Interior, Census Office. Compiled by George E. Waring, Jr. Part I. 4to. Washington. 1886.

THE SANITARY CONDITION OF THE DWELLING HOUSE.

THE Sanitary Science Club of the Association of Collegiate Alumnæ of Boston sends us a circular letter and certain questions of a series which are intended to call the attention of housekeepers to the sanitary condition of the house.

INTRODUCTION.

The questions are so framed that an affirmative answer implies a satisfactory arrangement, and they also suggest a remedy if the answer is negative. The compilers say:

"In thus pointing out the sources of danger, and the ideal standards of sanitation in the perfectly healthful house, we do not intend unnecessarily to alarm or discourage the householder. It is their aim to urge the intelligent oversight of these matters, and to indicate the points requiring investigation, the methods of examination, and the practical remedies.

"The conditions required under the two topics (situation and drainage) which open the subject, may seem as difficult of realization, especially to those already settled in their homes, as they are important. But while the suggestions would be of greater value to those considering the choice of a residence, yet it is believed that it will show those who assume that the conditions of their houses are beyond their control, that the remedy frequently lies within their reach. The second topic (drainage) is necessarily somewhat technical, but it is hoped that the explanation in the notes will prove that the difficulties are more apparent than real, and that the principles can be easily understood.

"It is unavoidable that some of the questions, in a subject so full of detail, should appear in themselves trivial, but the sum of such trifles often makes the difference between physical vigor and weakness. One of the most dangerous qualities of the insanitary house is, that it does not always produce at once a definite and virulent disease, such as typhoid fever or diphtheria, though such is often its result, but, without doubt, it slowly and insiduously causes ill-health and general languor, which incapacitate for sustained effort, and to which women are especially subject from their greater confinement to the house.

"In conclusion, the householder must be reminded that it is not enough to secure right sanitary conditions; they must be maintained. This can best be done through the internal vigilance of the housekeeper, who can thus, in large measure, secure the two essentials of a happy home—good health and its attendant, good nature.

"The following motto should be the basis of her efforts:

"'Any invention intended to be a substitute for watchfulness will prove a delusion and a snare.'"

HOUSE-DRAINAGE AND PLUMBING.

Have you a plan of the system of pipes in your house?

Is all the plumbing-work exposed to view or easily accessible?

Are the fixtures on the different floors placed over each other so as to avoid horizontal soil and waste-pipes.

Note I.—Fixtures include water-closets, wash-bowls, tubs, sinks, etc.

Note II.—The *soil-pipe* conveys the contents of water-closets and urinals to the house-drain. It may also receive the contents of waste-pipes. The *waste-pipes* carry other refuse fluids, as of tubs, sinks, wash-bowls, etc., only. These pipes may either discharge directly into the house-drain or into the soil-pipe. The *house-drain* is the pipe which receives the contents of the soil and waste-pipes, and conveys them outside the house. It is nearly horizontal, with an inclination of at least one in fifty, while the soil and waste-pipes should be vertical.

Are all the pipes air-tight, as shown by the peppermint test?

Note.—Pour two ounces of oil of peppermint into the soil-pipe at its mouth above the roof, if it is accessible, or into the basin or water-closet nearest the roof. Pour in immediately after a pail of hot water. If the odor of peppermint is perceived at any lower fixture, it is an indication that there is an opening in some pipe through which foul air may escape. The peppermint should be kept outside the house until needed, and the person who pours it in should remain on the roof, or in the room with closed doors, until the examination of the fixtures below has been made by an assistant, otherwise the odor will come from the bottle, or the clothing of the person, and spoil the test.

Is the continuation of the house-drain outside the house to the sewer or cesspool properly laid?

Does each water-closet have a sufficient supply of water discharged with sufficient force when emptied completely to scour the traps and branch waste-pipes—*i. e.*, two or three gallons to each closet at each flushing?

Are all objects excluded from the water-closet which are likely to obstruct the pipes, such as hairs, strings, rags, china, glass, or any thing not quickly and easily dissolved?

Are the water-closets flushed from a special cistern used for that purpose alone, and never as a supply for drinking or cooking?

When a fixture is not used for some time, is the evaporation of water in its trap, which would destroy the seal and admit foul air to the house, prevented by pouring a layer of oil over the surface of the water in the trap?

Are all stationary lavatories excluded from sleeping-apartments?

(*a*) Are overflow-pipes in tubs and bowls frequently flushed with clean water?

(*b*) Do they connect with the waste-pipe between the bowl and its trap?

HEATING.

Is your cold-air inlet at least two feet above the ground?

Does the surface around it slope away sufficiently to carry off moisture rapidly?

Are your registers so placed as to collect as little dust as possible?

Are they in the wall?

Are they large enough for the room they try to heat?

If they are in the floor, do you take them out at least once a month, and have them thoroughly cleaned and the pipe wiped out with a damp cloth as far down as possible?

When the room is being swept, or the furnace shaken down, do you place a damp cloth over your registers?

Are the registers so placed with regard to the fire-place or ventilator, or window, that the pure warmed air on entering the room may not at once pass out by the outlet for foul air, and thus cause a draught, and lessen the benefit from the furnace?

If your house is heated either wholly or in part by open fires, do you see that an abundant supply of fresh-air is furnished to your fuel, to avoid the formation of carbonic oxide by imperfect combustion, and also that the air to replace that which passes up chimney may not be drawn from other parts of the house?*

Are the draughts of your chimney strong enough to carry away all the products of combustion?

Is the hearth laid on a brick arch?

LIGHTING.

Do you arrange for the introduction of an abundance of pure air into every room in which a lamp or a gas-jet is burning to make up for the oxygen consumed by the flame?

Is sufficient precaution taken to provide means for the quick removal of the gases generated by the flame?

Note.—One 4-foot gas-jet burning Boston gas will give off about 37 litres, or $1\frac{1}{3}$ cubic feet of CO_2, and will use up as much air as two people. A kerosene burner, if it is a large one, probably consumes much more than a gas-jet.

If you burn kerosene,

(*a*) Do you use oil of 120° Fah. flash test, as shown by the open tester? (*b*) Do you take care to select the best burner possible? (*c*) For putting out the light, does the burner have some mechanical means of shutting off the flame? (*d*) If not, are you careful to turn the flame down and blow across the top of the chimney and never directly down into it? (*e*) Do you boil the burners in water, containing a little washing-soda, to prevent creeping of the oil, as well as to clean them? (*f*) Are you careful not to leave the lamps with the flame turned down? (*g*) Do you furnish such lamps as have a separate opening for filling? (*h*) For carrying about the house, do you provide "packed" lamps which have wicking saturated with oil and no liquid?

If you burn gas,

(*a*) Are your gas-pipes and fixtures tight, so that no gas can escape into the room? (*b*) Do you use the modern gas-globes, with large openings at the bottom?

A CITIZENS' committee has been appointed in Lowell, Mass., to act with the Board of Health in promoting sanitary conditions in the factories.

COMMISSIONER NEWTON, of the Department of Public Works of this city, has requested citizens to do what they can to check waste of water.

---

* With coal, a *blue flame* indicates the presence of carbonic oxide.

Patents.

352,857. Sewage and Night-Soil Incinerating Apparatus. Philipp C. Close, Augusta, assignor of one-third to Joseph S. Bean and Frederick T. Lockhart, Richmond County, Ga. Filed February 23, 1886. Issued November 16, 1886.

352,872. Refrigerator-Building. Theodore J. Hughes and Edward H. Hughes, Philadelphia, Pa., Theodore J. Hughes administrator of said Edward H. Hughes, deceased. Filed March 27, 1885. Issued November 16, 1886.

352,874. System of Temperature Regulation. Warren S. Johnson, Milwaukee, Wis., assignor to the Johnson Electric-Service Company, same place. Filed April 20, 1886. Issued November 16, 1886.

352,879. Heating-Stove. Eugene L. Messenger. Fulton, N. Y. Filed December 26, 1885. Issued November 16, 1886.

352,894. Treating Sewage. John W. Slater, Holloway, County of Middlesex, and William Stevens, London, England. Filed March 31, 1885. Patented in England December 1, 1884 No. 15,810, and December 17, 1884, No. 16,592. Issued November 16, 1886.

352,896. Water-Heater. John H. Swager and Jacob F. Ferchen, Astoria, Oreg. Filed December 19, 1885. Issued November 16, 1886.

352,908. House-Heating Device. John R. Barker, Chicago, Ill. Filed December 22, 1885. Issued November 23, 1886.

352,940. Gas-Regulator. Moses G. Wilder, Philadelphia, Pa. Filed April 6, 1886. Issued November 23, 1886.

352,943. Water-Purifying Apparatus. James H. Blessing, Albany, N. Y. Filed September 4, 1886. Issued November 23, 1886.

FOR SALE.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD will move on or about January 15, 1887, to more commodious quarters at the corner of Fulton and Gold Streets. They have, therefore, for sale a HOT-WATER HEATING-APPARATUS for which they have no further use, consisting of a Hitching's No. 15 Corrugated Fire-Box Boiler, 600 feet of 3-inch pipe and necessary valves and expansion-tank.

The present rooms, containing 2,200 square feet of floor space and 18 windows, are also to rent, and the fixtures for sale at a sacrifice. Apply on premises, 140 William Street, New York.

New Advertisements.

J. G. & T. DIMOND, New York. Architectural Iron-Work. P. 102.

MANLY & COOPER M'F'G CO., New York and Philadelphia. Ornamental Iron-Work. P. 102.

BARSTOW STOVE CO., New York. Bay State Ranges and Furnaces. P. 103.

MERCHANT & CO., Philadelphia, New York, and Chicago. Roofing Plates. P. 103.

NEW YORK EXHAUST VENTILATOR CO., New York. Power-Ventilator or Air-Propeller. P. 103.

PULSOMETER STEAM-PUMP CO., New York. New Pulsometer. P. 104.

DEACON WASTE-WATER METER. P. 104.

PROPOSALS. P. 105 and Supplement.

LOEBER BROS., New York. Photographic Outfits. P. 106.

KELLY & JONES CO., New York. Steam-Heating Specialties. P. 119.

NATIONAL ELECTRIC-SERVICE CO., New York, Chicago, and Boston. Heat-Regulating Apparatus. P. 119.

CONNOLLY M'F'G CO., Brooklyn, N. Y. The Connolly Patent Globe-Trap. P. 121.

THE STANDARD SOAPSTONE CO., New York. Laundry-Tubs. P. 121.

THE J. L. MOTT IRON-WORKS, New York and Chicago. Sanitary Specialties. P. 122.

THE MEYER-SNIFFEN CO., New York, Boston, and Chicago. Sanitary Specialties. P. 123.

SCHOOL OF MINES, Columbia College, New York Technical Instruction. P. 124.

INSTITUTE OF TECHNOLOGY, Boston, Mass. Technical Instruction. P. 124.

SEEVENS HIGH SCHOOL, Hoboken, N. J. Technical Instruction. P. 124.

HENRY CAREY BAIRD & CO., Philadelphia. The Techno-Chemical Receipt Book. P. 124.

EMPLOYMENT WANTED. P. 124.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 6. } PUBLISHED EVERY SATURDAY.

NEW YORK, JANUARY 8, 1887.

LONDON, JANUARY 22, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. } IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 140 William Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— —— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

"OUR TALL BUILDINGS."

THE SANITARY ENGINEER AND CONSTRUCTION RECORD has often called attention to the violation of sound principles of hygiene in the adoption of the extreme heights to which buildings are now being carried. The dark lower rooms, with the absence of sunlight and the necessary introduction of artificial light, the increased difficulty in securing proper ventilation, the terrible drafts and downpours of wind in the vicinity of such obstructions, the heavy shadows and interferences with the rights of adjoining property, the increased danger to occupants in case of accident or fire, all point to the necessity for effectual legislative interference to prevent the spread of what we consider an evil. We are glad, therefore, to see that the *Commercial Advertiser* has drawn attention in recent articles to this important subject, and hope that the press generally will agitate it until a proper law is passed and enforced. The corner of Nassau and Beekman Streets in this city demonstrates the necessity for such action.

THE IRON AND STEEL INDUSTRY.

THE *Bulletin* of the American Iron and Steel Association concludes, from its summary of business in 1886, and the fall trade, that the outlook for 1887 is good, though coupled with this is the statement that prices must stop where they now are, or the importation of these metals will reach enormous proportions, to the injury of American manufacture. During the past year, notwithstanding the strikes, the production of iron and steel has exceeded the product of 1885 by more than 2,500,000 gross tons, reaching a total of nearly 10,000,000 tons. This great increase was largely due to the demand produced by the immense railroad building operations of the United States during the year, resulting in the construction of more than 7,000 miles of new railroad, as compared with 3,131 miles constructed in 1885. One of the indications of the prosperity looked for in 1887 is the continuance and increase of this same railroad development. Notwithstanding the great demand, however, prices for iron and steel advanced but slightly, the highest increase between January 1 and December 29, of a list cited by the *Bulletin*, being ·25 per cent. for gray forge pig-iron, while iron nails show actually a decrease in price. The stock of pig-iron on hand is estimated at not more than that for the close of 1885, about 370,000 gross tons—a very small surplus when the wants of the country are considered.

THE MASSACHUSETTS WATER-SUPPLY AND DRAINAGE LAW.

THERE can be no more important questions relative to the public health of any community than those which pertain to its water-supply and its sewerage. For a dozen years or more the State of Massachusetts has conducted important inquiries relative to both of these subjets through its State Board of Health, and also through the different commissions appointed to devise the best methods for the drainage of its populous communities, especially the city of Worcester and the immediate neighborhood of Boston.

A decided step in advance was taken by the legislature of 1886, by the enactment of a law "to protect the purity of inland waters." This act gives to the State Board of Health a general oversight of the water-supplies and systems of sewerage of cities and towns, requires the board to make examinations of the waters of the State with reference to their adaptation to domestic use, requires them also to consult with city and town authorities with regard to their water-supplies and systems of sewerage, and also requires all authorities, corporations, and others intending to engage in manufacturing business liable to injuriously affect inland waters to submit plans for the disposal of their sewage to the board.

Authority is also given to appoint the necessary officers to execute the provisions of the act. The State Board of Health, acting under such authority, has organized an Engineering Department, consisting of the following: Joseph P. Davis, Consulting Engineer; Frederic P. Stearns, Chief Engineer; X. H. Goodenough, Assistant Engineer—appointments that will secure the respect and confidence of the engineering profession.

Several towns have already taken advantage of the privileges conferred by this act, and have submitted to the board plans for the water-supply or sewerage of their respective communities. Among these may be named the towns of Medfield, Winthrop, Bradford, Orange, Stoneham, and the cities of Taunton and Brockton, the latter being an application relative to a surface or storm-water drain only.

In some cases the plans have been approved as submitted; in others certain modifications or alternatives have been advised by the board. The town of Medfield voted to construct a sewer for the relief of its village, the disposal of its sewage to be effected by irrigation upon a plot of land well adapted to the purpose about a mile distant. The plan was approved by the board after examination by its engineers.

The town of Winthrop submitted plans for its sewerage, mainly upon the separate system, with disposal into the sea upon Winthrop Bar, at a considerable distance from the land. This plan was also approved by the board with certain modifications.

Questions relative to water-supply and sewerage were submitted by the town of Bradford. As to the former, three different sources were proposed as alternatives—the Merrimac River, a pond in the town, and a supply to be obtained from the ground. Analyses of the river-water made by the board proved that the water was unfit for use, its quality being bad, as compared with samples obtained higher up the stream above Lawrence and Lowell, both being large manufacturing cities whose entire sewage entered the river, and also showing progressive deterioration as compared with samples taken in 1873 and 1879. The pond-water was also shown to be of poor quality. It was advised that examinations should be made with reference to a supply from the ground at some distance from the river.

The benefits which are to be anticipated from such an act cannot be estimated from the few months' trial which the law has had. Municipalities seeking counsel are not alone in the advantage gained. Neighboring communities must also in many instances receive protection where harm might otherwise be done without intelligent supervision. With careful administration and with a liberal appropriation for its exe-

cution it is clear that such a statute must in the end prove to be one of the most effective measures for the maintenance of the public health. The act is published elsewhere in this issue.

THE BALTIMORE AND OHIO RAILROAD CATASTROPHE.

IN our issue of November 6 we called attention to the urgent necessity there is for legislative intervention to compel a radical change in the methods now employed for heating and lighting cars. The two disasters recorded during the past week again impress the lesson in a most fearful manner. The fact cannot be controverted, that it is *possible* to build cars in such a manner as to greatly lessen the dangers to the occupants from the effects of collision or derailment, and that it is also possible to so heat and light them as to *entirely* remove the danger of a repetition of the horrible scenes enacted in the three accidents cited and numerous others in past times. This being true, Congress should at once pass a stringent enactment compelling all interstate lines to adopt the changes necessary to insure the safety of passengers on such lines; and we may then hope that the several States will so supplement such action by the legislation necessary to remove forever this dark blot on our railroad management.

Until forced by legal means, the telegraph and telephone companies thought it impossible to remove their unsightly wires from our streets; in like manner our railroads will never adopt the plain remedies which lie at their hands to remedy this present disgraceful state of affairs until they are forced to do so.

THE Civil Engineers' and Surveyors' Association of Connecticut will hold its annual meeting in the city hall, Hartford, January 11. B. H. Hull, of Bridgeport, will read a paper on "Tunnelings," by invitation of the organization.

THE builders and architects of Cincinnati are taking steps to establish a permanent building exhibition in that city.

OUR BRITISH CORRESPONDENCE.

Editing the Writings of Mr. Edwin Chadwick—The Manchester Ship-Canal—The Floating Hospital on the Tyne—Checking Water-Waste at Bradford—Experimental Artesian Wells for London—Draining the Pinsk Marshes—Protest against the Sanitary Registration of Buildings Bill—Dividend from the Artisans' Dwellings.

LONDON, December 22, 1886.

I NOTICE that Dr. B. W. Richardson is editing a work embracing the writings of Mr. Edwin Chadwick, C. B., on questions of sanitary science.

The promoters of the Manchester Ship-Canal, the scheme for which was temporarily abandoned after being put before the public a few months since, are again taking steps to ask subscriptions of the public to the undertaking. An influential committee has held inquiry and taken evidence as to the probable result of such an investment, and estimates a return of 5 per cent. to the shareholders.

The floating hospital on the Tyne, built by the Port Sanitary Authorities, on the design of Mr. W. G. Laws, the Newcastle City Engineer, has just been launched. I gave a description of this new departure in hospital work some months since.

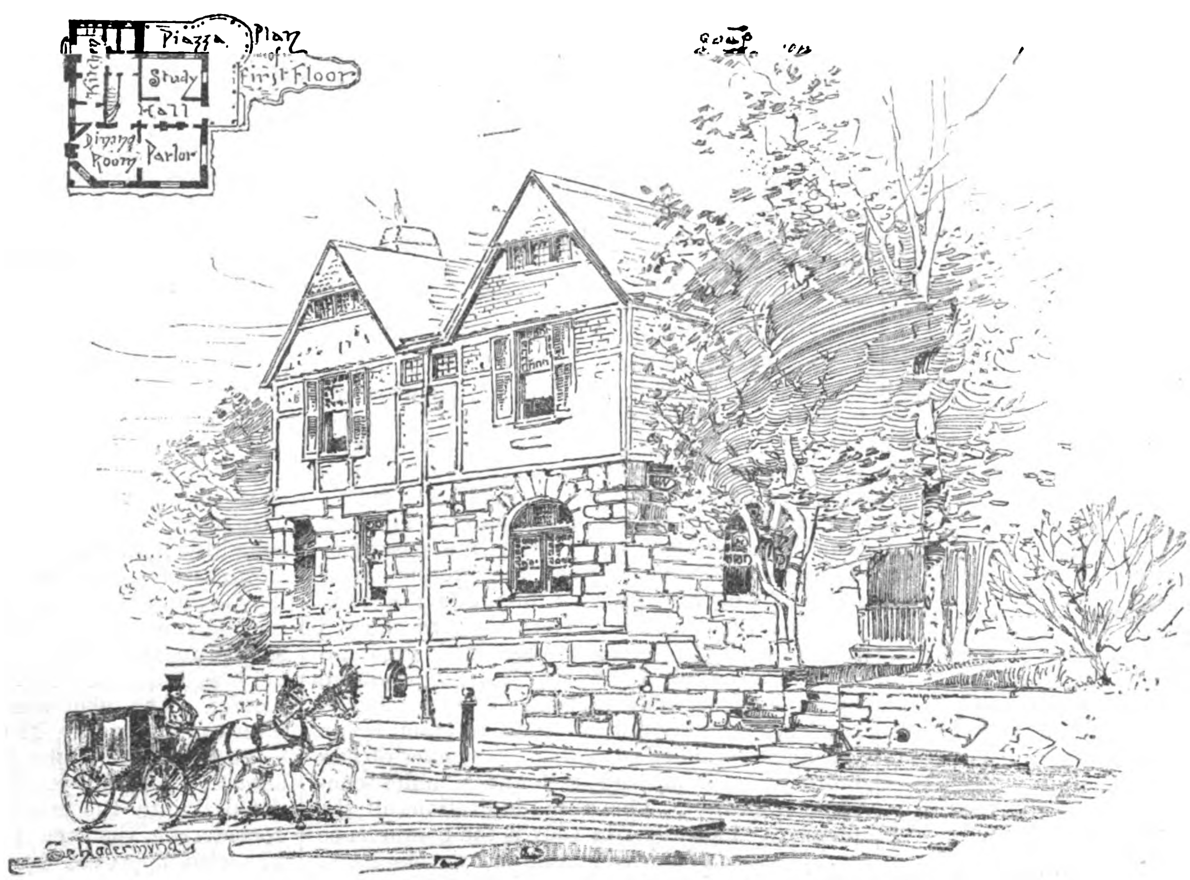
An interesting report on water waste is made by Mr. Binnie, the water works engineer at Bradford, Yorkshire. Taking one district of Bradford, having a population of 81,000, the daily supply averaged 22.47 gallons per head. With a view to localizing the waste, Mr. Binnie subdivided the district, providing each subdivision with a Deacon's meter, and gradually narrowing the subdivisions until the actual house, wherein the waste occurred, was found. The result was to diminish the supply to nine gallons per head per day, this being on constant pressure. The saving effected to the corporation for twelve months amounted to close upon £13,000 ($62,400).

In connection with the counsel's opinion stated to the Corporation of the City of London some few months since, to the effect that the water companies had no power to restrict the use of artesian wells, the Common Council has determined to sink such wells, with a view to testing the question as to supplying the city with water.

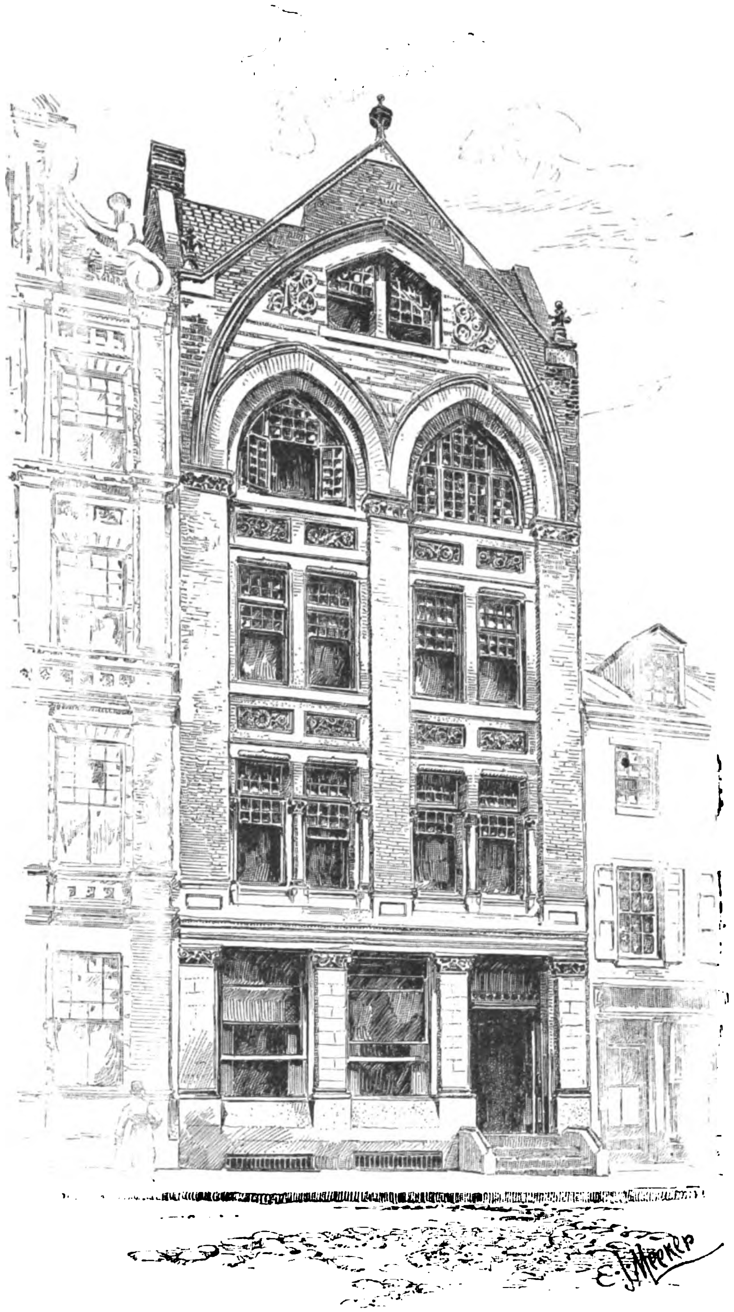
A drainage scheme of considerable magnitude is being carried out in Russia. The object is the reclamation of the Pinsk Marshes, situated on the Russo-Polish frontier, and the work has been in operation since 1873. The total area of the district is 25,000,000 acres, and of this some 5,000,000 acres have been reclaimed up to the present time. Over 1,000 miles of ditches and canals have been constructed in the course of the work. The operations have been carried out under the Government.

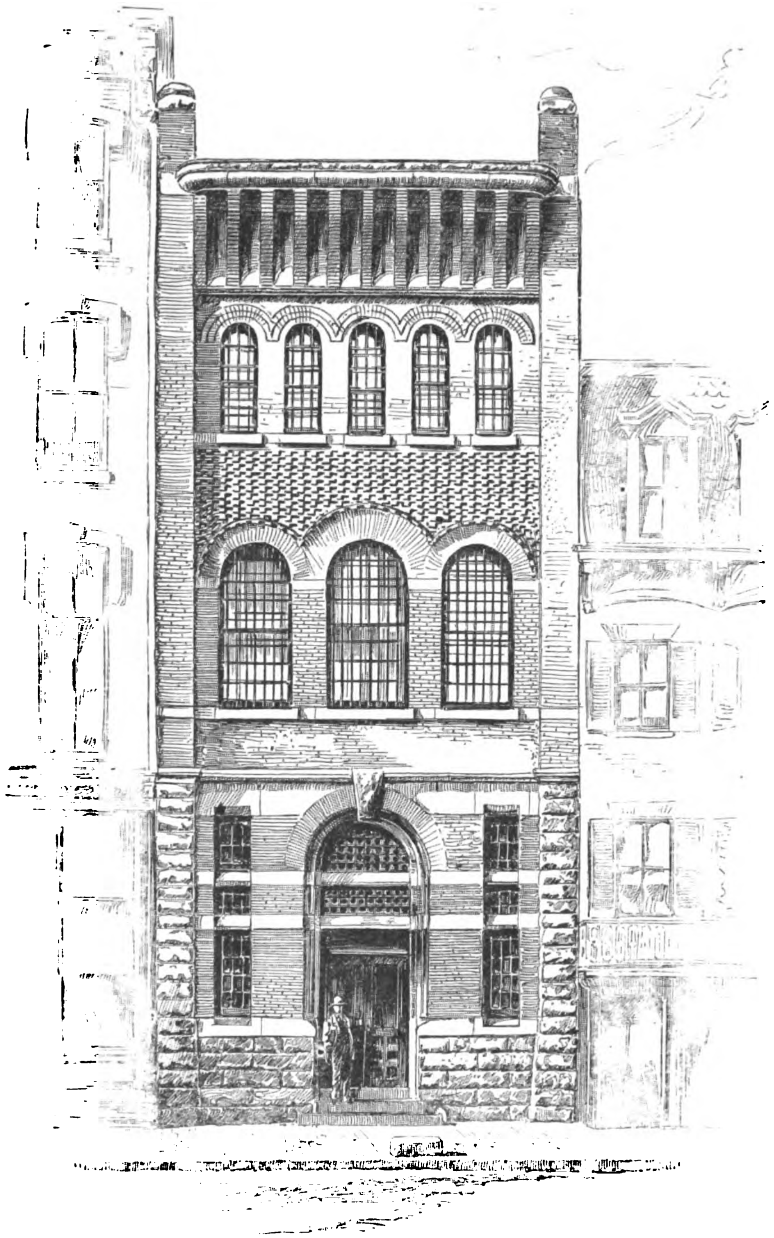
I referred some time since to a bill which was to be laid before Parliament, entitled, "The Sanitary Registration of Buildings Bill." I notice that the Society of Medical Officers of Health have entered a protest against the bill, apparently on the ground that there is not sufficient security in the qualifications necessary for persons giving certificates.

Bearing on the question of the erection of artisans' dwellings as a business investment, it is interesting to note that the City and Central Dwellings Company have resolved to pay a dividend at the rate of 5 per cent. per annum for the current quarter. The buildings under the auspices of this society have been erected about eighteen months, and are situated in the district of St. Luke, London, E. C. They consist of seven blocks, standing on 38,000 feet. Each block accommodates on an average 48 families, giving in round numbers a housing capacity of about 1,300 to 1,400 people. On the other hand, the number of people living on the site before the erection of the buildings was less than 150. The total outlay was £48,000 ($230,400), including the extra cost of fire-proof construction. There are no basements, and each room is lighted and ventilated from the external air. The rental in the blocks for a three-room tenement is 7*s.* 6*d.* per week ($1.80), for two rooms 6*s.* and 6*s.* 6*d.* ($1.44 and $1.56), and 4*s.* 6*d.* ($1.08) for one room. It may further be pointed out that these were the first buildings erected by the company, that there was extra cost in connection with the foundations, which had to be sunk to a depth, in some instances, of twenty feet, and may, therefore, be assumed that in any future building of a like nature, experience will show where a saving can be effected, resulting in making the concern even more profitable and secure as an investment. SAFETY-VALVE.



RESIDENCE AT YONKERS, N. Y.—HENRY RUTGERS MARSHALL, ARCHITECT.





THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES

TWO COMMERCIAL BUILDINGS.

ROYAL INSURANCE BUILDING, PHILADELPHIA.

JAMES P. SIMS, ARCHITECT.

WASHINGTON SAFE DEPOSIT COMPANY BUILDING.

HORNBLOWER & MARSHALL, ARCHITECTS.

ENGINEERING & ARCHITECTURE

OUR SPECIAL ILLUSTRATION.

A BUILDING IN PHILADELPHIA, PA.—JAMES P. SIMS, PHILADELPHIA, ARCHITECT.

A BUILDING AT WASHINGTON, D. C.—HORNBLOWER & MARSHALL, ARCHITECTS.

THE subject of one of our special illustrations is a building in Philadelphia, owned by the Royal Insurance Company. The exterior is of stone up to the sills of the second-floor windows, with terra-cotta and brick above. The building is 26 feet front by 102 feet deep. Mr. James P. Sims, of Philadelphia, was the architect.

The subject of our other special illustration is a building in Washington, D. C., owned by the Washington Safe Deposit Company. The front is of pressed brick and black granite, from the York, Pa., quarries. The interior of the business-room is of pressed and glazed brick for floors, iron beams and brick arches. A large portion of the building is separated from adjoining houses by three independent but adjoining brick walls. The rafters are in two tiers upon and above the level of the ground floor, with their doors so situated as to be visible from the street at all hours. The metal-work was made by the Herring Company. The vaults are surrounded by brick walls, and are entirely independent of the construction of the building proper. There is a well-lighted area-wall around them, and they are carried upon longitudinal walls in the basement, so that watchmen can walk all around, above, and below them. Messrs. Hornblower & Marshall, of Washington, D. C., were the architects.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE AT YONKERS, N. Y.—HENRY RUTGERS MARSHALL, ARCHITECT, NEW YORK.

The subject of our vignette is one of several houses built for the late F. N. Bangs, at Yonkers, N. Y. The exterior of the building is of wood. The outside finishing of the lower story is of clapboards, with shingles above. The cost was $10,500. Mr. Henry Rutgers Marshall, of New York, was the architect.

COTTAGE (SMALL) HOSPITAL CONSTRUCTION.

BY HENRY C. BURDETT.

Author of Cottage Hospitals, Pay Hospitals of the World, etc.

No. XII.*

CONVALESCENT HOME FOR CHILDREN, ST. LEONARDS-ON-SEA.

THE picturesque building which forms so prominent a feature at the extreme western end of the sea-front of St. Leonards is the outcome of a modest but excellent work carried on for some years in a small private house at the back of Warrior Square, the object of which is to provide the advantages of sea-air and good nourishment for poor children of London and other large towns when convalescent from ailments of a non-infectious nature.

The building stands on a cliff, and has an uninterrupted view southward toward the sea and northward toward the open country.

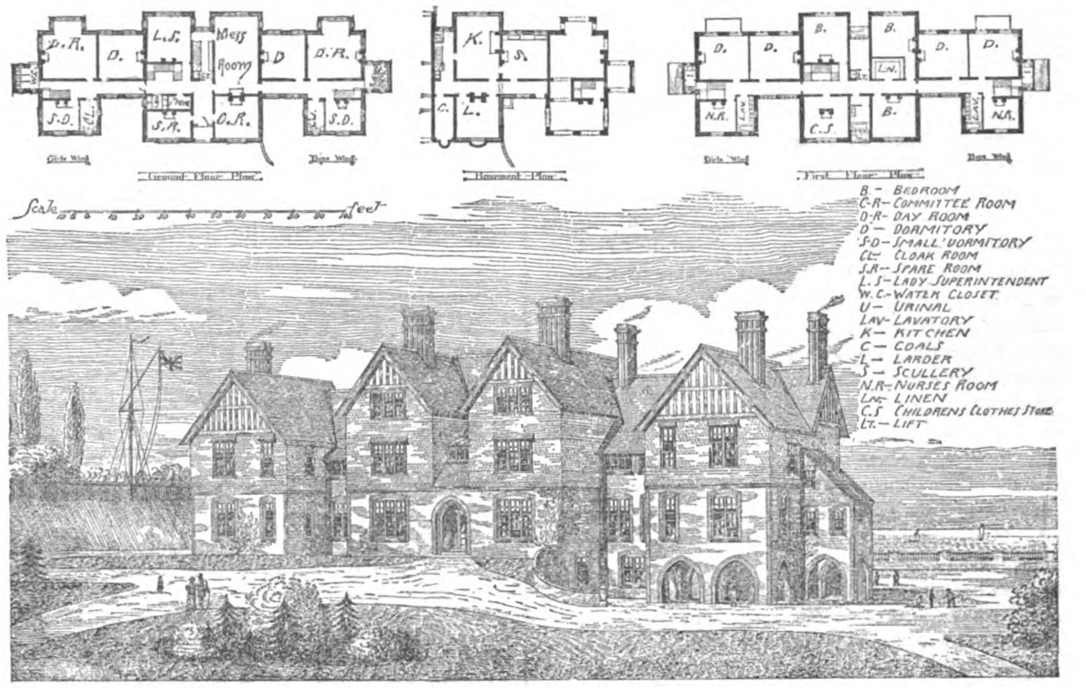
Advantage has been taken of the natural slope of the ground to place the kitchen offices and a covered playground in a lower story, which, though below the ground-level of the other parts of the building, is not below the level of the ground immediately surrounding it.

The central portion of the ground floor is occupied by the entrance-hall, committee-room, spare room, mess-room, and lady superintendent's room. The wings on either side contain each two dormitories, a cloak-room, a large day-room, with projecting bay window looking over the sea, and water-closets. The latter are placed in projecting buildings with cross-ventilated lobbies. The eastern wing is devoted to girls, the western to boys.

On the first floor the central portion is occupied by bedrooms for the staff, a linen store and a spacious store-room for children's clothes, provided with a fire-place. The wings are occupied by dormitories for children, lavatories, and bath-rooms and nurses' rooms.

Servants' bedrooms are placed in a second floor over the central portion.

The walls up to the first-floor level are built hollow and faced with local red bricks and Suffolk brick quoins; above



that they are built with local clamp bricks and faced with weather-tiling. The roofs are covered with plain tiles.

The appearance of the building is extremely pleasing and appropriate, and a thoroughly successful architectural effect is obtained by the use of the most simple and inexpensive means.

* No. XI Subiton Cottage Hospital, was illustrated in our issue of December 20, 1886.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. VII.

THE EQUITABLE BUILDING.

(Continued from page 112.)

ONE of the most interesting pieces of work that has been done of late in the architectural line is that of enlarging the Equitable Building in this city. Drawings showing the character of the changes made and the magnitude of the work will be given in a subsequent issue. It is greatly to the credit of the contractors and all engaged upon the work that it has been done with entire safety to the public at one of the most crowded points in the city, and with almost no

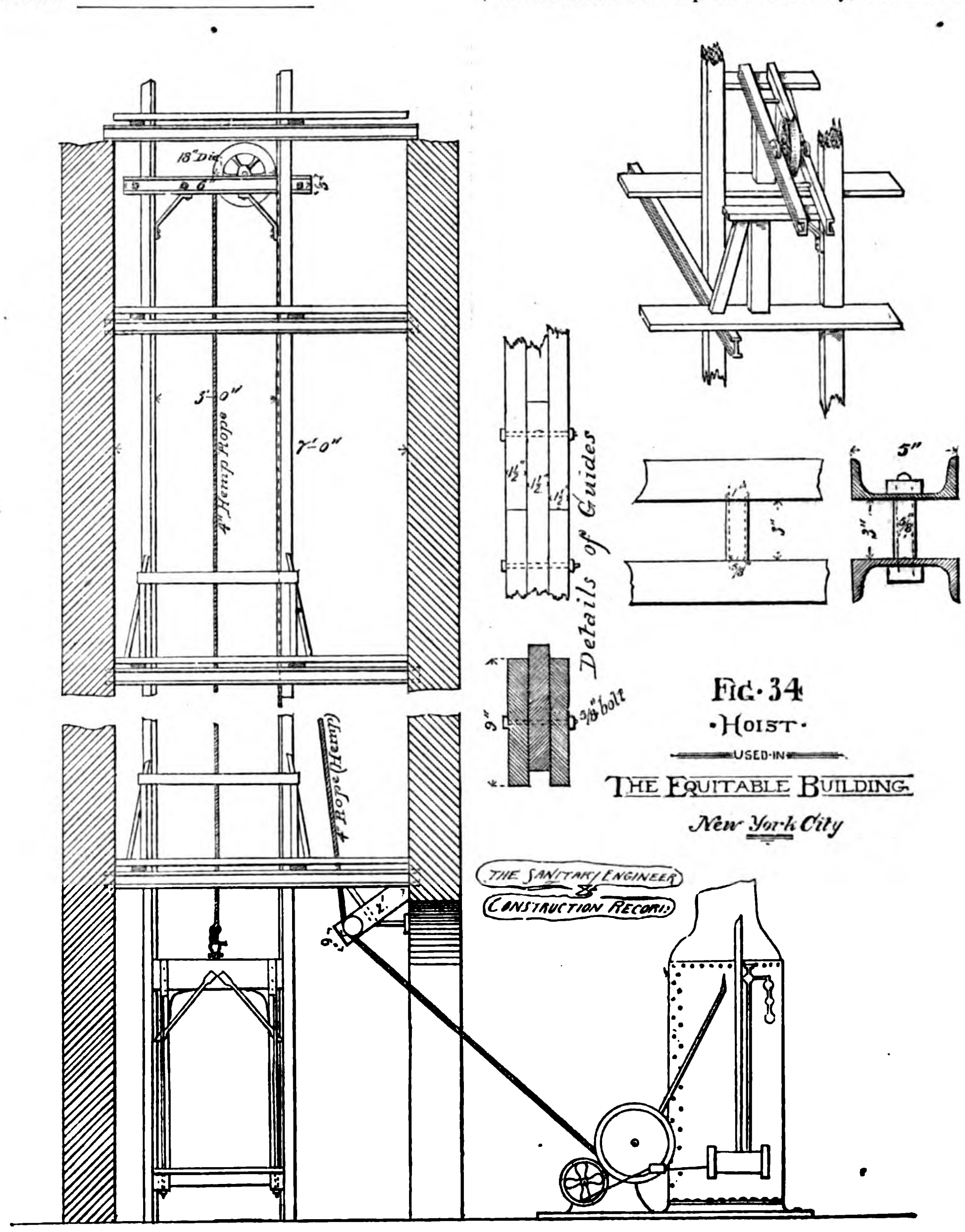


FIG. 34
HOIST
USED IN
THE EQUITABLE BUILDING
New York City

interference with traffic on the sidewalks or in the streets. As soon as practicable, a shelter was built over the sidewalk, consisting of 12x12-inch posts, with timbers of the same size supporting a working platform. All work of handling material and dressing stone was done from this platform, instead of from the sidewalk and street, and no unsightly piles were ranged along the gutters, as is too often the case. A hoarding was erected above this, and continued as the work progressed, to the full height of the building. This served to prevent all danger from falling bricks or fragments of any kind. The arrangements for handling material were well worked out. A large derrick on each street worked by steam hoisted the heavy work (stone, iron, and timber) to the story where it was to be used, and for points not within reach handy and substantial trucks were used. By means of these it was carried within reach of breast derricks, which placed it as desired.

We have only space in our present number to illustrate an exceedingly simple but very effective hoist for brick, mortar, and small loads of other kinds. Similar hoists have been used heretofore for hods filled with brick, etc., but each hod requires a man at top and bottom to handle it. The hoist illustrated is arranged to take up two wheelbarrows at a time. By this means the work is much more rapidly done, with fewer men, and much less effort on the part of the men. The speed of hoist is about six feet per second, and the lowering is done at about twice this speed. No further description is necessary, as the figure explains itself.

We take occasion here to mention the names of the various parties responsible for the work, to many of whom we are indebted for information we shall give our readers in subsequent issues.

The architect is Mr. George B. Post, of New York. The builder is Mr. D. H. King, Jr., who is responsible for the entire management of the work. The contractors for the granite work are Messrs. J. G. Batterson & Co., whose representative, Mr. William Angus, of Hartford, has charge of the stone-cutting. Messrs. J. G. Batterson & Co. and A. L. Fauchere & Co. are contractors for the interior marble-work. Messrs. John Cavanagh & Son, of Boston, and F. & S. E. Goodwin, of New York, are contractors for the shoring, a work of very considerable difficulty, as will be seen by our description to be hereafter given.

(TO BE CONTINUED.)

AN ENGLISH VIEW OF WOMEN AS ARCHITECTS.

IT has of late been largely agreed that there are many fields of work, hitherto complacently occupied by men only, which there is every reason to suppose could be as worthily filled by women. In making fresh suggestions in this sense I would say that my remarks have more direct reference to the girl and young woman of the middle class than to those of the artisan class. What really valid objection is there to asking her to become a "draughtswoman," and in due course an architect?

Surely an occupation such as the preparation of architectural drawings, requiring neatness and delicacy of touch, attention to detail, patience, and care is one which would seem at first blush more likely to find its proficients among women than men. Let us, then, look into the course of training that prevails, and see if it offers any considerable bar to the adoption by women of architecture as a profession. In brief, the routine is as follows: A youth on leaving school with an aptitude, more or less, for the profession is articled as pupil for four or five years to an architect to whom he pays a premium. This is, of course, in proportion to the position and repute of the architect in question, but may be stated at from a hundred pounds to four or five times that amount. As with solicitors, so among architects, the pupil is supposed by having "the run of the office" to acquire an intimate knowledge of its work, design, draughtsmanship, knowledge of materials, official routine, and so on. If a young fellow of parts, he soon begins to "feel his legs" and to understand his work, and, if wise, supplements his office instruction by attendance at the admirable classes of the Architectural Association and elsewhere. At the end of his articles he is qualified to dub himself a "junior draughtsman," in which capacity he claims as salary from a pound to two pounds a week. A couple of years should then see him a draughtsman proper, and in a position to obtain three, three-and-a-half, or four guineas a week. In many cases, of course, thanks to such "backing" of his friends as he may be fortunate enough to get, the lucky pupil can set up on his own account immediately his articles are completed.

In this routine which I have briefly sketched there are only two objections that stand in the way of its adoption by women. Against the first, which is the "commingling of the sexes" caused by the admission of women as part of an ordinary office staff, we can adduce American experience. Here they are frequently employed as typewriters and so on. But even should conservatism insist vigorously in this respect, we can at least compromise with it and suggest a "women-clerks' room" as a solution of the difficulty. The second objection is the difficulty women would experience as regards the inspection of buildings and the necessary mounting of the scaffolding for that purpose. While reminding the objector that women decorators have been known to work for days on scaffolds, and that there are such things as "divided skirts," I would say that I am more particularly suggesting that women's work in an architect's office should be "drawing-board work," such as ornamental and other detail drawings, competition sets of plans, schemes of color decoration, and perspective drawings. The simpler department of tracing has, I am told, been tried, and with some success, by the Ladies' Tracing Office in Westminster, and other ladies, besides the Misses Garrett, have taken up decoration work and a certain amount of architecture connected with it. My plea is for a further advance on the part of women into a territory of which there is no reason that man should occupy the whole.—*Mr. C. Harrison Townsend in the Pall Mall Gazette.*

SEWERAGE OF PROVIDENCE, R. I.

OUR readers will recall that we recently noted the appointment by the city of Providence, of Messrs. Joseph P. Davis, Rudolph Hering, and Robert Moore, a committee to examine and report upon Mr. Samuel M. Gray's plans for the sewage disposal of the city. Their report has been sent to the Mayor, and by him was, on December 27, transmitted to the City Council. We present a full abstract, as much of the information is useful to other communities. Mr. Gray's recommendations are endorsed.

"In pursuance of our duties," the engineers say, "we assembled in the city of Providence, November 2, 1886, and spent the following week, until November 9, in examining the plans, profiles, and estimates for an improved sewerage system for said city, made by Mr. Samuel M. Gray, City Engineer, and referred to in the foregoing resolution, and also in examining on the ground, in company with Mr. Gray, the site of all the works embraced in said plans, including an inspection of the Cove, the Providence River, and Narragansett Bay. We also checked over the estimates and computations of the City Engineer far enough to satisfy ourselves that said estimates were carefully made, and that they are large enough to form a safe basis of action. Such differences from these estimates as may appear hereinafter in this report are due, not to any corrections of Mr. Gray's figures, but solely to modifications of the plans upon which they were based.

"Our examination of the routes of the intercepting sewers, as proposed by Mr. Gray, whilst not sufficient to enable us to pass upon them in detail, was ample to satisfy us that, as a whole, they are correct, and are substantially such as will be required to relieve the rivers and the Cove of sewage, whatever be the plan adopted for its final disposal. Our attention was, however, particularly directed to the location of the proposed inverted syphon across the Providence River, and, as a result, we are of opinion that the location near Fox Point, as proposed by Mr. Gray, is the correct one, rather than a crossing at Crawford Street Bridge, as has been suggested by others, the reasons for the choice set forth by Mr. Gray, in his report of February 2, 1886, being entirely sound.

"As the merits of the various plans for cleansing the rivers and removing the sewage nuisance, under which the city of Providence now suffers, depend almost wholly upon the means adopted for the final disposal of the sewage, it is to this point, as applied to this particular case, that our attention has been chiefly directed.

"But before discussing the several plans which are open for adoption by the city it may be well to indicate in the briefest possible manner the principal methods by which the sewage of towns may be finally removed. This will be done not so much for the purpose of giving information, for this whole subject has been very fully treated by Mr. Gray in his report of November 14, 1884, as that our use of terms may be clearly understood.

CRUDE DISPOSAL.

"The first and most common method of removing town sewage is to discharge it from the city sewers directly, and without any treatment to render it less offensive, into the ocean, or into a running stream. This is termed crude disposal, and if the stream be large, or the tidal current be strong enough to take the sewage at once and completely away, is a satisfactory and sufficient method of removal; the exceptions being where it may pollute a source of drinking supply, or cause a nuisance to towns lower down the stream. But if the stream be small, or the tidal current be not strong, this method is to the highest degree unsatisfactory, as may be very clearly seen in the present condition of the several streams which flow through the city of Providence, as well as that of the Cove and the city harbor.

"A modification of this method of disposal, which is in use in London and in Boston, Mass., and which has been suggested for adoption by Providence, consists in storing the sewage during the incoming tide in a reservoir, and discharging it during the first one or two hours of the outgoing tide. In speaking hereafter of crude disposal at Field's Point it is to a scheme of this kind we shall refer.

IRRIGATION AND INTERMITTENT FILTRATION.

"A second method of disposal is to divert the sewage from the rivers and turn it on to the land for purposes of irrigation. By experiment it is found that, up to a certain limit, which varies with each case, when sewage is put upon land, all its offensive qualities are taken up or destroyed, and such of it as finally percolates through the soil is thoroughly purified and may pass into the streams without causing any trouble. As just stated, however, this has its limit. Different soils differ widely in their powers of purification; open and sandy soils being in this respect the best. The rule of quantity generally adopted in England is that an acre of land will purify the sewage of 100 persons, or from 4,000 to 5,000 gallons per day.

"In order to increase the capacity of soils for the purification of sewage, a method has during the last fifteen years come into use in England, which consists in underdraining the land to the depth of six or seven feet, grading the surface into level beds, and then applying the sewage intermittently, giving the land frequent periods of entire rest, during which it is aerated and its powers restored. By this method it is found that the ability of the land to purify sewage is very greatly increased. When first proposed by Dr. Edward Frankland, of London, he was of opinion that by this means one acre could be made to cleanse the sewage of 3,000 persons. Experience has not verified these expectations, and the rule now generally adopted is that it is not safe to apply to land the sewage of more than 1,000 persons, or from 40,000 to 50,000 gallons per day. Even then the result will not always be satisfactory.

"This latter method of preparing the land and applying the sewage is termed intermittent filtration. When there is no special preparation of the land and no care taken to give it regular periods of rest it is termed broad irrigation, and the terms will be so used by us throughout this report.

PRECIPITATION.

"Still another method of disposing of sewage is by what is termed precipitation. This consists in collecting it into tanks or reservoirs, where it is treated with certain chemicals which cause the greater part of the suspended matters to fall to the bottom in the form of a semi-liquid mud, which is termed 'sludge,' leaving the water above comparatively, if not wholly, colorless and transparent. The principal reagent employed in nearly all processes of this kind is lime, and in the largest precipitation works—those of Leeds and Birmingham—it alone is used. In addition to lime, many other chemicals are employed, such as alum, copperas, perchloride of iron, charcoal, etc., by means of which it is claimed that greater quantities of the suspended matter are thrown down and a purer effluent obtained. In no case, however, are the matters in solution, as contradistinguished from those in suspension, more than very slightly reduced, so that the supernatant water, though clear, is not pure, and should not be discharged into a stream used for drinking-water.

"With this outline view of the various methods of sewage disposal, we may now proceed to a consideration of the several plans which have been proposed for dealing with the sewage of the city of Providence. These are:

"1. Disposal at Seekonk Plains.
"2. Crude disposal at Field's Point.
"3. Disposal at Warwick Plains.
"4. Precipitation at Field's Point.

"Each of which we will consider in the order named:

I. DISPOSAL AT SEEKONK PLAINS.

"In considering the scheme for disposing of the sewage at Seekonk Plains, for which Mr. Gray, in his report of February 2, 1886, has submitted an estimate, the fact at once appears that if broad irrigation be adopted, the amount of land available for this purpose (being less than 1,200 acres) is barely sufficient for present requirements and leaves no margin whatever for the future needs of the city. Intermittent filtration, for which the land is fairly suitable, is the only method of disposal which should be seriously considered at this point. We find, however, that much cheaper land of equally good or better quality for this purpose exists at Warwick Plains, a point more remote from the centre of population, and where, because of this remoteness from habitation, carelessness in the management of the process will cause much less annoyance than at Seekonk Plains. These and other considerations of minor importance make it evident that the advantages for disposal of the sewage on the land are much greater at Warwick Plains than at Seekonk Plains, and we think it is, therefore, useless to enter into any detailed discussion of plans for the latter place.

2. CRUDE DISPOSAL AT FIELD'S POINT.

"The discharge of the sewage, in its crude state, at Field's Point, although involving works of somewhat greater first cost than are required for precipitations, is yet, on account of its smaller current expenses, by far the cheapest of all the modes which have been proposed for disposing of the sewage of the city. We understand, however, that the sentiment of the citizens of Providence is much opposed to this method of disposal. Nor is this surprising. The shores in this vicinity are used for summer residences and as pleasure resorts; bathing beaches are near at hand, and during the summer and fall months these waters are much frequented by excursion parties, attracted by the cool breezes of the bay, and the beauty of its shores. Extensive oyster-beds exist in this vicinity, and the fishing interests are said to be of some importance. The float experiments made by Mr. Gray show that the strong and well-defined outward tidal current, which is found opposite Field's Point shortly after the ebb tide sets in, begins below this point to diminish in force and become diffused. The direction of the surface currents is greatly influenced by the wind, but, as a rule, matter discharged at the Point during the hour and a half after high tide would meet the incoming tide before reaching Gaspee

Point, and would be carried backward a considerable distance toward its place of starting, unless sooner grounded on one of the shores. With a westerly wind the tendency is to strand on the east shore, and probably the bathing beaches on that shore, between Squantum and Sabine's Point, and even below would be much injured.

"Considering all the interests at stake in preserving the bay and its shores from even the apprehension of nuisance —interests of a kind which relate to the health and pleasure of the people, and cannot, therefore, be measured in money values—we are of the opinion that the plan of crude disposal at Field's Point, by which these interests might be jeopardized, is inadmissible.

3. DISPOSAL AT WARWICK PLAINS.

"At Warwick Plains are found about 2,200 acres of land available for irrigation. The soil is of good character for this purpose, and the situation is in many respects favorable. But, looking to the future, when the city of Providence shall have a population of 300,000, this is not sufficient land to dispose of the sewage in a satisfactory manner by broad irrigation. On this account, and also because we find disposal by intermittent filtration to be the cheaper and, all things considered, the better method, we have made an estimate of the cost of a scheme for this method of disposal, and shall use it rather than the estimate for broad irrigation given in Mr. Gray's report for purposes of comparison with the scheme of precipitation at Field's Point.

"In making this estimate we have assumed that 1,000 acres of land will be purchased at once, not only to allow for the future needs of the city, when the land may be much more difficult to acquire, but also to afford in the first instance greater latitude in the management of the farm. Filter-beds are well adapted to a variety of crops, particularly to those of market gardening. But to admit of the greatest possible use from such cultivation it is advantageous to operate in connection therewith a stock or dairy farm. The crops from the filter-beds may, by this means, be partially utilized upon the farm with better results than from direct sales in the market. This surplus land may be fertilized by broad irrigation if found advisable, but in our estimates we have made no allowance for preparing it for this purpose, either by underdrainage or by grading the surface.

"Mr. Gray's estimates, both for precipitation and for irrigation, are based upon caring for a dry-weather flow of 9,000,000 gallons of sewage daily, including about 3,000,000 gallons of manufacturing waste— that is to say, while the intercepting-sewers and other parts of the work which cannot be enlarged except at great cost and inconvenience are made of capacity sufficient for a population of 300,000, or a dry-weather flow of sewage of, say, 24,000,000 gallons daily, those parts of the works which are intended for the treatment of the sewage, and which can easily be extended from time to time, as required, are proportioned to a dry-weather flow of 9,000,000 gallons.

"In our estimate of the cost of filtration we have assumed the same basis of sewage flow, and have, as far as possible, adopted the same scale of prices as Mr. Gray, which, as before stated, we consider liberal and safe. For the cost of the whole system of intercepting-sewers, which is the same in this as in the precipitation scheme, we have taken Mr. Gray's figures, without change—viz., $2,195,973. We have further assumed that, as an average through the year, each acre of land, when properly prepared by underdrainage and grading, will dispose of 45,000 gallons daily, this being about the same as the English basis of 1,000 people per acre.

"Upon these assumptions we find the total cost of the scheme for intermittent filtration at Warwick Plains, including the purchase of 1,000 acres of land, and the special preparation of 200 acres for use as filter-beds, to be $4,620,000. Sludge-tanks are provided at the farm to remove from the sewage, by simple sedimentation, without the use of chemicals, the solid and slimy matters which would tend to clog the pores of the soil, such removal being, in the opinion of the best judges, necessary to secure the best working of the system of intermittent filtration where so large a quantity is put on the land, as is proposed in the present instance.*

"The yearly cost of operating, including the expense of pumping the sewage and the care of the sludge, we estimate at $28,000 per year. The subsequent cost of distributing the sewage over the land and the care of the filter-beds, as well as the cost of management and operation of the farm, we assume will be repaid by the sale of the products.

"As to the expectation of profit from the application of sewage to the land, our opinion is decidedly adverse. Irrigation in dry climates, or even in moist climates, if the water be applied only at such times and in such quantities as are needed, is a most valuable aid to agriculture, but where the water comes and must be cared for night and day, and every day in the year, and in largest quantities in rainy weather, when it is needed least, the case is very different. It then becomes more of a hindrance than a help. And, whilst there are in England a number of towns, mostly of small size, where sewage farming on the process of intermittent filtration has resulted in a profit, yet, in the case of Providence, where the climate forbids the production of any crops for nearly half the year, and where no experience has been gained in such farming, we think our assumption that the cost of distributing the sewage and the management of the farm will be recovered from the sale of its products is as favorable as it is safe to make.

4. PRECIPITATION AT FIELD'S POINT.

"In this scheme it is proposed to pump the sewage from the main intercepting sewer into tanks located at Field's Point, where it will be treated chemically. The clarified effluent will be conducted, by means of an outlet sewer, to a point midway between the shore and Fuller's Rock Light, where it will be discharged at the bottom of the channel, in such manner as to secure the utmost possible diffusion. This is the scheme recommended by Mr. Gray, and for which he has given an estimate of cost in his report of November 14, 1884.

"We have made a new estimate of those parts of the work which are intended for the raising, storing, and treatment of the sewage, but as it gives a result not differing materially from Mr. Gray's estimate, we adopt his figures, which show a total cost of the precipitation scheme to be $3,699,504, or, say, $3,700,000.

"As to the yearly cost of treatment, it is hardly possible to give the exact figures, owing partly to the want of experience in such work in this country, and partly to a want of certainty as to the standard of purity in the effluent that will be required at different seasons of the year. We have, however, estimated the cost of thorough treatment throughout the year, of a sewage of average quality, believing that, in practice, it will be found that a much less quantity of chemicals will be required in the colder months than we have provided

"The yearly cost of pumping and treating the sewage, when the dry-weather flow shall have reached 9,000,000 gallons per day, we estimate at $65,000, believing, however, that in practice this may be reduced to $53,000.

COMPARISON OF THE SCHEME OF INTERMITTENT FILTRATION AT WARWICK PLAINS WITH THAT OF CHEMICAL PRECIPITATION AT FIELD'S POINT.

"It remains now to weigh the comparative merits of the two latter schemes, as, in our judgment, it is between these two that the choice must lie.

"And, first of all, to what extent will these two schemes accomplish the end for which they were designed and free the city from sewage nuisance? For any plan which does not accomplish this should be at once dismissed from consideration.

"In answer to this inquiry our opinion is clear that success may be attained by either scheme.

"That sewage may be effectually disposed of by intermittent filtration does not now admit of any doubt. Since this method of disposal was first proposed by Dr. Frankland in 1870 it has been tried in a large number of towns in England, and in a few instances in this country—the principal one being at the town of Pullman, Ill. In all cases, except where the essential requirements of the process have been grossly violated, its success in producing an effluent clear, colorless, and free from all noxious or putrescible matters has been complete. In the language of Rivers Pollution Commissioners of England, land prepared for intermittent filtration is 'not a mere mechanical contrivance,' but 'a machine for oxidizing, and thus altogether transforming, as well as merely separating, the filth of dirty water. A field of porous soil irrigated intermittently virtually performs an act of respiration, * * * for it is alternately receiving and expiring air, and thus dealing as an oxidizing agent with the filthy fluid which is trickled through it.'

"After fourteen years experience, Mr. Bailey-Denton, C. E., who was first to accept the suggestion of Dr. Frankland and put the plan into practical operation, says:*

"'No instance of failure can be pointed out where careful underdrainage and careful preparation of surface, with proper periods of rest (regulated by the character of the soil) have been adopted, whereas the cases are unfortunately becoming numerous in which effective effluents are discharged from the underdrains, and considerable nuisance created on the surface of the sewaged ground where "intensified irrigation," without regulated periodical application, has taken the place of intermittent filtration, as explained by the Rivers Pollution Commissioners.'

"To the same effect is the testimony of the Royal Commission on Metropolitan Sewage Discharge, from whose second and final report, made November 27, 1884, after an investigation of over two years, we quote as follows: After saying, in regard to broad irrigation, 'That, generally speaking, it offers a satisfactory mode of disposing of town sewage,' and 'that when properly arranged and carefully conducted, the effluent will be effectually purified,' they proceed further on, when considering the process of intermittent filtration, as follows: †

"'As to the *purity of the effluent*, the Rivers Pollution Commissioners said it would be difficult to decide between filtration and irrigation, but there are some reasons why the filtration process would seem to have the advantage. In the first place the system and motive of working would be totally different, the purification being the principal thing aimed at, and the vegetation only secondary and subsidiary, so that the attention of the management would naturally be directed to the quality of the effluent as the chief aim.' * * * * * * *

"In regard to the liability to objection we believe this process has the advantage over broad irrigation. For the liability of nuisance would, if the sludge were previously removed, be reduced by the smaller area of land exposed, and the danger to subsoil waters would be diminished by complete and skillful underdrainage. The cost of the process is materially affected by the much smaller quantity of land required.

"As regards the particular case in hand we find the land at Warwick Plains to be of a kind well suited for filtration, being very largely sand and gravel, with a covering of light soil, so that we have no doubt that, if proper care were taken in the matter of underdrainage and grading the surface, and the sewage applied with proper intervals of rest, it would be thoroughly purified, and the city freed from the nuisance under which it now suffers.

"Turning now to the scheme for chemical precipitation at Field's Point we think that this method will also deal effectually with the sewage, and afford a satisfactory solution of the present problem. Precipitation processes have been in operation in England for the last thirty years, and the experience there gained is more than that of all the world besides. A committee appointed in 1880 by the city of Glasgow to investigate the subject of sewage disposal* sum up, in their report, the results of experience bearing upon this point, as follows:

"'There are processes of precipitation now in operation, which give an effluent capable of being discharged into a river with perfect inoffensiveness, and without sensibly destroying its purity, provided always that the volume of sewage is small compared with that of the river. * * * Whatever be the process of chemical purification to which the sewage is subjected, the effluent is still impure, and will putrify and give off noxious gas, if kept for some time; and we know of no way in which the purification can be completed but oxidation. Filtration through cultivated land—*i. e.*, irrigation—is probably the best means. But oxidation of the effluent may, in most cases, be effected by the simple and natural process of running it into the nearest water-course, when, if the proportion of clean water be sufficient, the organic matter will be gradually oxidized, and the effluent water will not become putrid or offensive in any way, even in warm weather.'

"The fact seems to be, that the nuisance of sewage is almost wholly due to the suspended matter. If this be taken out by the process of precipitation, dilution with a sufficient quantity of water, usually stated to be twenty times the volume of the sewage, is all that is needed to insure the complete destruction of the organic matters which remain. In the present instance, the large volume of water which passes Field's Point is amply sufficient to diffuse and oxidize without offence many times the quantity of clarified sewage which will ever be poured into it.

"We have no doubt, therefore, that a precipitation process at this point, properly worked, will so effectually dispose of the sewage that it will cause no further trouble.

"In claiming for these two schemes that they will effectually dispose of the sewage, we do not mean to say that there will not at times be unpleasant smells in the immediate neighborhood of the works. The pumping station, screening chamber and the precipitation tanks, as well as the sludge tanks of the filtration scheme at Warwick Plains, will, under certain atmospheric conditions not be free from objectionable odors. With good management there should ordinarily be no smell noticeable outside the works, and even at the worst the trouble will be strictly local. In no case will there be anything detrimental to the public health, nor anything that can be properly called a nuisance.

"Both schemes, then, being satisfactory solutions of the problem in hand, and as such substantially equal, we must compare them next from the financial point of view.

"As we have already stated, the first cost of the filtration scheme will be $4,620,000, whilst the cost of the precipitation scheme is $3,700,000, showing a difference in favor of the latter of $920,000.

"This, however, is not conclusive. The question of annual cost must also be taken into account.

"This is made up of three elements—interest upon first cost, operating expenses, and repairs—including in the latter the cost of maintaining and, when necessary, completely renewing such parts of the works as are of a perishable nature. Summing the first two of these elements for each scheme we get the following:

"For the filtration scheme:

Interest upon $4,620,000 at 3½ per cent...	$161,700 00
Operating expenses, including pumping and care of sludge	28,000 00
Total..................	$189,700 00

"For the precipitation scheme:

Interest upon $3,700,000 at 3½ per cent.......	$129,500 00
Operating expenses, including pumping and cost of precipitation........	65,000 00
Total......	$194,500 00

"The third element of the annual expenses—to wit, the repairs and renewals of perishable parts—hardly admits of a satisfactory estimate. It is evident, however, that when we consider the much greater cost of the machinery required to pump to the sewage farm, the larger amount of iron submitted to the action of sewage, and the liability to derangement in a complicated system of the drainage, that this item of expense will be the greater for the filtration scheme. And, when we consider further that the cost of treating the sewage is likely to be considerably reduced below the cost given in the preceding estimate, it seems quite certain that, in the matter of annual cost, as well as in first cost, the balance will be favor of precipitation.

* See Second Report of Royal Commissioners on Metropolitan Sewage Discharge, 1884; pages XLV., XLVIII. Also, Bailey-Denton's Ten Years' Experience, etc., etc., Second Edition, page 21.

* See "Ten Years' Experience (now fourteen years) in Works of Intermittent Filtration." London, 1885, page 33.

† See Second Report of Royal Commission on Metropolitan Sewage Discharge, 1884, page 43, paragraph 213; and page 47, paragraph 220.

* See Report Royal Commission on Metropolitan Sewage Discharge, page XXIV., paragraph 169.

"Another consideration tending, as we think, to incline the scale in the same direction, is the greater simplicity of the organization necessary to carry on precipitation, as compared with filtration.

"The kind and quality of chemicals required to produce a satisfactory effluent having been once determined by the experience of the first few months, during which time the greatest care and skill will be well rewarded, the process afterward will be mainly a matter of routine. This will be especially true at Providence, where the effluent will be discharged into a large body of moving water, whereby it will be at once greatly diluted and dispersed. In discharging into small fresh water streams, where the dilution is small, the character of the effluent has to be much more carefully watched, and, if economy be studied, the treatment varied as the character of the sewage varies from the day to the night hours, and from season to season. But, under the conditions existing at Providence, after the kinds and quantities of chemicals best suited to the local conditions have been once determined and the best methods of manipulation established, the works will need, for their successful management, only a small force of laborers under the charge of a faithful and intelligent foreman.

"The process of intermittent filtration is also, in itself, and if nothing but the purification of the sewage be aimed at, one of routine and simplicity, but when carried on in connection with farming and market gardening, it is no longer a simple mechanical process, but a business venture, which requires for its success the employment and dismissal of many men, the handling of considerable sums of money, and the constant exercise of a skill and foresight of no mean order.

"On this subject Mr. Bailey-Denton, who is one of the warmest advocates of the application of sewage to land, and who has done more than all others together to develop and bring into use the process of intermittent filtration, remarks:

"'That a sewage farmer, to qualify himself for success, must serve a special apprenticeship to the occupation. Moreover, it has been made clear, that an ordinary farmer is no better qualified to deal with sewage, without such apprenticeship, than a gardener; for not only is it necessary to know what grasses and vegetables can be best treated with sewage, and to regulate the frequency of application, and the quantity of liquid, to gain the best return, but it is absolutely essential that he should be able to effect the best and readiest sale of his crops, when fit for market, and so conduct his operations with reference to the demands of local markets, and of such other markets as he can reach, as will conduce to the growth of only such crops as he can most readily sell. By this means he will reduce to a minimum the losses incidental to all food-production, for it is quite certain that, in the long run, the man who sells the most at the right moment, and who aims at converting into milk or meat what he cannot sell, is the person who will make the most money. To do this, it is absolutely requisite that every sewage farm should have upon it sufficient buildings to house a proper number of milch cows and pigs, to consume a portion of each season's produce.

"'It is essential, in fact, that a tenant of a sewage farm should combine in his own capabilities the practical qualities of a farmer, a gardener, and a market salesman, which will induce him to avoid all treatment of a *dilettante* character, and lead him to embrace in his management the growth of such crops as will keep him most favorable before the market he serves.'*

"In other words, to conduct a sewage farm of 1,000 acres is an enterprise calling for a high order of business capacity, and above all demanding a constant watchfulness and study, which experience shows can be expected only where a strong personal interest is at stake, and in which any kind of corporate management is apt to lead to failure. So long, therefore, as another course is open for adoption, we cannot advise the city of Providence to incur the risks which a business undertaking such as this will involve.

CONCLUSIONS.

"Summing up our conclusions, we find as follows:

"1. That in order to cleanse the rivers and the Cove all sewage must be kept out of them, except in time of storms.

"2. That this can be accomplished only by a system of intercepting sewers, substantially such as that proposed by Mr. Gray.

"3. That of the various schemes for final disposal of the sewage the two which we consider best are those for intermittent filtration at Warwick plains and chemical precipitation at Field's Point.

"4. That either of these will dispose of the sewage in a satisfactory manner and in a way to free the city from nuisance.

"5. That in this respect the two plans are substantially equal.

"6. That of these two the precipitation scheme is, in first cost, the cheaper by $920,000.

"7. That in annual cost the balance will probably be in favor of precipitation.

"8. That the organization needed for precipitation is simple having in view but a single object—the purification of the sewage.

"9. That the organization at Warwick Plains will have two objects, one the purification of the sewage, the other the somewhat complicated business of conducting a large farm with a view to profit. In other words, it will be a business venture in which the city should not embark unless there be no satisfactory alternative.

"10. For these reasons the scheme of chemical precipitation at Field's Point is, in our judgment, the one best worthy of adoption.

"All of which is respectfully submitted.

"JOSEPH P. DAVIS.
"RUDOLPH HERING.
"ROBT. MOORE."

REPORT ON THE VENTILATION AND LIGHTING OF THE CROTON AQUEDUCT TUNNELS.

FROM the report of Rossiter W. Raymond and W. H. McQuail to the Aqueduct Commissioners on the condition of ventilation and lighting of the new aqueduct shafts and tunnels we quote as follows:

It is obvious that the condition of the air in every working depends upon many circumstances, especially the number of men, animals, and lights in it; the length of time they have been there; and the amount and time of the last preceding blast. The latter is the most important factor of variation.

The air in this heading, shaft 12, was not very bad. Lights could be seen 450 feet, the last blast having been 4½ hours previous to our visit. This result was evidently due to the exhaust from the drills and the comparative shortness of the heading. A more effective auxiliary ventilation will undoubtedly be required as the heading advances.

At shaft 31 the air was rather bad (five hours after blasting) in both headings, lights being visible for about 250 feet only. The kerosene-lamps were the principal cause. Candles, or lard, sperm, or the best "miner's" oil would give far less smoke than kerosene.

Lights at the heading of shaft 30 were visible 150 feet away. A gasoline torch at the shaft was visible for a little over 300 feet.

In shaft 29 both headings are short, and the air was clear in both, except between the bench and face of the north heading, where it was very close and smoky.

In shaft 28, where the headings are shortest of all—a little over 100 feet each—the air was good at the time of our visit, 6½ hours after blasting.

In shaft 27 the air was rather close and murky in both headings. Lights at the faces (about 175 and 200 feet away, respectively) could be scarcely seen at the shaft.

As to the ventilation, we presume the contractors do not expect to be able to carry the work through without employing a mechanical system; and, such being the case, it would be economical to introduce such a system soon, and get the benefit of it in increased efficiency of labor and rapidity of progress. We consider the use of positive blowers or fans and iron pipe the only system to be recommended.

In shaft 24 the south heading is not working, and the north heading, being connected through to shaft 22, has plenty of air. Descending shaft 23, we walked through to 22, finding the draught so strong as to require weather-doors for the comfort of the bricklayers. Electric-lights and miners' lamps gave sufficient light. The oil used is lard-oil.

In shaft 22, north heading, now 3,219 feet long, ventilation is assisted by a No. 5½ Baker blower at the mouth of the shaft, and a 12-inch spirally-riveted iron pipe, carried to within 250 feet of the face of the heading. The blower is run at 100 revolutions per minute, and should displace at this speed 3,000 cubic feet of air per minute. The actual delivery at the inner end of the pipe--that is, after all deductions for friction and for leakage--is shown by anemometer test to be about 1,326 cubic feet per minute. To this is to be added the air leakage from the pipe under pressure and the exhaust air from the drills when these are running.

The practice at this place is to suck with the blower for about half an hour after blasting and to blow the rest of the time. We regard this as the most rational method, for the following reasons:

1. The temporary and local accumulation of the smoke and gases from blasting is thus removed before it has had time to diffuse itself through the tunnel. That the time required for this work is limited will appear upon a simple calculation. The area of the cross-section of the tunnel is (say) 200 square feet, and the gases of blasting may be assumed to occupy 250 feet, in length of the tunnel, making 50,000 cubic feet of foul air to be removed by suction. This is an overestimate, by reason of the decreased actual area at the face, where it is diminished by the bench and by the rock thrown down; but the excess in the estimate will cover the amount of air which it may be advisable to allow to blow from the "manifold" in the compressed-air hose at the very face, in order to stir and move the smoke, etc., towards the suction-pipe. Assuming the effective suction to be 1,325 cubic feet per minute, though we think it would be greater than the effective blowing capacity through the same pipe, it is plain that the body of air described could be removed in less than 40 minutes, and half an hour would doubtless be sufficient to enable the men to return to the heading.

2. While this operation is going on all leaks in the pipe are inward, and hence the noxious gases are removed with certainty.

3. The heading itself can be more rapidly cleared by blowing, but this would be at the expense of the rest of the tunnel, through which the smoke, etc., would be driven and diffused.

4. Suction may also be employed for short periods with advantage at points where blasts in "trimming" or other causes have produced local accumulations of bad air. For this purpose caps on the pipe might be provided at intervals, which could be used for local sucking or blowing. But it would be less expensive, and probably satisfactory, to disconnect the pipe at the desired point and connect it again after the operation. In case of blasting the pipe would have to be removed anyhow.

5. But while suction is the best way to effect the immediate removal of dense accumulations of noxious gases, it is not the best for dealing with such diffused impurities as the smoke of lamps, the exhalations of men and animals, etc. This is particularly true under the conditions obtaining in the aqueduct tunnels.

a. The natural circulation in the tunnel is greatly weakened by the refrigerating effect of the discharge from drills, while, on the other hand, the amount of fresh air thus discharged, though inadequate of itself for ventilation, greatly benefits the neighborhood of the face, and would, if allowed to escape through the tunnel, benefit the whole line.

b. But sucking near the face, while the drills are running, is practically doing little more than drawing out again at once the fresh, cold air which they deliver, and leaving the body of the tunnel relatively "dead." What effect is produced on the body of the tunnel is in antagonism to the natural "upcast" current of the shaft. At the shaft there is usually a warm column of air, due to the pump-exhaust and other causes, and (except in very warm weather) this current naturally ascends. When the shaft is the only opening there must be in it a descending as well as an ascending current, and this division can be much facilitated by bratticing the shaft. But in the case of a second opening, such as is furnished by a ventilating pipe or flue, it is manifestly better to make the shaft the upcast, and blow through the flue.

c. To draw cold air into one upcast, while warm air is seeking another, is to leave the body of air between them relatively unaffected. In other words, under the conditions stated, the shaft is sucking at one end of a long tunnel, and a blower is sucking at the other.

d. By blowing cold air into the heading, the effect of the drills is reinforced, and a current is set up towards the shaft, which is the proper direction. The natural and the artificial ventilation then work together, and the maximum effect is produced.

e. Leaks in the pipe deliver fresh air to the tunnel.

6. The condition of natural ventilation is variable, and under some circumstances it may be advisable for special reasons to reverse the current in the pipes. The system pursued at shaft 22, however, and above described, is generally the best, and has been followed with complete success in headings, much longer than any on the Aqueduct. It is highly important that the blower should be so mounted as to be reversed at will without changing the belt. This is the case at shaft 22, but not at some other shafts, where, in consequence, sucking all the time or blowing all the time is the practice preferred.

At shaft 21 the No. 5 Baker blower sucks exclusively. Running at 125 revolutions it should displace 3 125 cubic feet of air per minute. The velocity of the intake in the south heading over 2,000 feet from the blower, is shown by the anemometer to be 2,060 feet per minute through a 10-inch pipe, or about 1,120 cubic feet per minute. The ventilation is reported to be satisfactory; but we prefer the larger blower, the larger pipe, and the reversing system, as practiced at No. 22. No. 21 is at present the natural upcast for 20 and 19¾, an additional reason for blowing instead of sucking.

At shaft 19 there is a No. 5½ Baker blower connected with an 18-inch iron pipe down the shaft, and a 12-inch

* See Bailey-Denton on Intermittent Downward Filtration, Edition of 1885, pages 98-99.

pipe to within 150 feet of the bench in each heading. The blower is run at 150 revolutions and blows exclusively. The delivery in the north heading, about 1,700 feet from the shaft, as calculated from the anemometer reading, is 1,114 cubic feet; in the south heading, over 2,000 feet from the shaft, it is 1,177 cubic feet per minute. The small difference is doubtless due to leakage or deformation of the pipe in the north heading.

At No. 9, south heading, the boxes are very large at the portal, but 150 feet in they drop to about 10x24 inches. The jets are reported to be 400 or 500 feet apart. The first we found working was 1,700 feet from the portal. It was blowing weakly. The next, also weak, was 350 feet further on; 420 feet beyond this was a stronger jet (to judge by the sound—the jets themselves being usually inaccessible, unless they were at the open ends of boxes); and 130 feet beyond this the boxes were interrupted. At this point the intake-current had a velocity of 220 feet, 367 cubic feet per minute. From this point to the face, say 600 feet, the air was very bad. Lights could be seen about 100 feet. The last blast had taken place at 7 A. M., about four hours before our visit. A hose was blowing air at the face. Two "muckers" only were at work there. Our candles clearly showed that the movement of air in the tunnel was everywhere outward, until we were about 500 feet from the portal, at which point we encountered the natural ventilating current. In other words, the jets and boxes were drawing no air from the main body of the tunnel, and only a portion of that which escaped from the hose at the face.

In another case it was intended to take foul air from along the roof. But instead of sucking, it was blowing briskly. We turned on the jet in advance of it (a rather feeble one), but the branch still showed a distinct current the wrong way.

But the system is bad for many reasons, among which the following may be named:

1. The compressed-air jet is well known to be an expensive and inefficient way of producing a current. There is a large loss of energy, in the form of heat, in the compression of the air; and the jet once produced is inferior in efficacy to the cheaper steam-jet of the same area and pressure, because the air expands as it escapes, thus adding to the volume to be propelled, and at the same time it chills the current, making it harder to move to an upcast; whereas the steam-jet condenses instead of expanding, and in condensing warms the current. Yet even the steam-jet has long been condemned in comparison with positive mechanical ventilation, like blowers and fans.

2. The operation of such an air-jet is this: It tends to impart its velocity to the body of air in front of it, and thus to create a rarefaction of the air behind. But much of this forward motion is soon wasted in internal eddies and revolutions of the air. The initial velocity soon disappears; the body of cold air in front resists heavily, and if there are leaks in the flue it escapes largely through them. The leaks in the boxes we have examined are usually found to be sucking inward when behind a jet and pretty near it, but blowing out when in front of a jet; and the outward leakage probably exceeds the inward considerably. The effect of both is, that such a line of boxes mixes the air in a tunnel rather than conveys it.

3. The numerous anemometer measurements made by us on these boxes have no value as direct indications of the effectiveness of ventilation—as they would have, if made upon positive currents. They prove the inevitable invisible leakage of the boxes, however, in a striking way. When, as in shaft 11 A, north heading, one-fifth only of the amount of air sucked in at one end of a continuous wooden flue, 980 feet long, is found to come out at the other end, *though three jets of compressed air have been added to the entering quantity*, it is plain that more than the missing four-fifths must have escaped by leakage. When, on the other hand, a ¼-inch "heading" jet set at the very end of the box-line draws in a strong current, and a similar jet a considerable distance from the end of its box-line draws a much weaker current, the forward action of the two jets being presumably the same, the inference is irresistible that there is leakage inward between the open end of the box and the jet. Smoke will not pass as freely as gases, and it is quite likely that most of the smoke which gets into these boxes is carried forward by the alternate pushing and sucking of the jets, and gets out of the tunnel. In this respect, however, they are undoubtedly less effective than the steady suction of a blower.

4. But if the boxes were absolutely air-tight, and the system worked perfectly, it would be merely a continuous upcast, such as is produced more positively by a sucking blower or fan; and, as such, it would be open to the serious objection that it would constantly take from the heading the fresh air discharged by the drills, and would operate against the natural ventilation. We have explained this view under a previous head. But the bad practice which we there criticised was only a way of using the apparatus which could be easily used in the way we recommended. In the case of the jets and boxes, the evil is inherent in the system. They can be operated in no other way.

5. In actual practice, the defects of this method are augmented. The boxes (freshly repaired when we saw them) have been very much more leaky. Yet we found numerous cracks, knot-holes, and sometimes openings big enough for the insertion of hand and arm. We were indeed once told that the leaks made no difference—"the circulation was kept up anyhow." But circulation is not always ventilation.

Moreover, the boxes are heavy and hard to move. When they are moved—to make way for the bricklayers, for instance—they are rendered more or less leaky by the mere handling; and careless replacement does not better the matter. There is similar but much less serious trouble with the iron pipes. They leak as a rule at the joints only; they can be easily handled and replaced; and their leaks are apt to betray themselves by noise and the escape of tangible streams of air. The silent, imperceptible leakage of rough, nailed boxes is far greater, and less easily remedied.

Again, the jets are constantly liable to get out of order, or to be incorrectly set, or to be turned off when they should be turned on, or *vice versa*. We were told that it was a part of the system that all the jets, except that nearest the face (the "heading-jet"), should be without valves and constantly blowing. We had, indeed, seen many jets of which this was true, but after our attention had been called to the point, it happened curiously enough that nearly every jet we encountered had its cock and could be turned off at any time by anybody, and many of them were found closed. In short, whatever may be the theory of the system it is practically certain to be operated so as to save the costly compressed air as much as possible.

The jets were found to differ irregularly in the diameter of nozzles from one-sixteenth up to three-eighths of an inch. In one case a jet had lost its nozzle and was blowing through a ¾-inch hole. The difficulty of controlling such matters is one of the objections to the system. But it is obvious that proper continuous inspection will measurably remedy this.

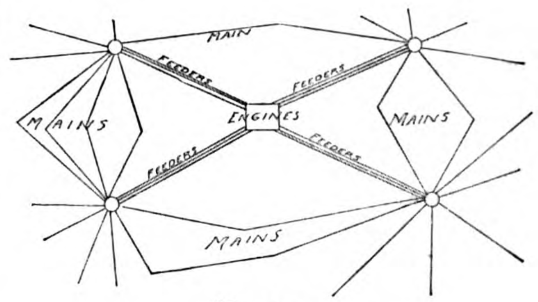
Notwithstanding the defects which we have pointed out, we think that the box and jet system, with the aid of the drills and the hose at the heading, and the steam-exhaust at the shaft, will, if properly watched, repaired, and maintained by the contractors, afford sufficient ventilation for the work, at least during the winter months, and while drilling and blasting are confined to one shift daily. Concerning its efficiency in hot weather, and when more frequent blasting and the presence of larger numbers of men augment the difficulties of the case, we are more doubtful. At present we should say that neither the surveying engineers nor the underground bricklayers need have cause to complain, if the existing means of ventilation are carefully and vigorously used. Wasteful and comparatively ineffective as they are, they can be made to give a fair atmosphere, as our experience in all but a few places indicated, under the conditions described.

In conclusion, we recommend that contractors who have not yet introduced a mechanical system of ventilation be urged to adopt large Baker blowers and 12-inch iron pipes, and that in all places where the box and jet system is now in use a vigilant inspection and careful maintenance of it be required that the system may at least do its best, in the hope that the expensive necessity of substituting a better system may be avoided.

EDISON ELECTRIC-LIGHT DISTRIBUTION IN BOSTON.

At the present time many of the Boston streets are being dug up near the curbing for the purpose of laying new electric wires. The Edison Electric Illuminating Co. has several gangs at work just now extending their lines of wires and putting them below the pavements, where they will be out of the public's way and free from harm.

Two kinds of wire mains are used by the company. The system of laying the wires is radial from the central office, where all the electricity is generated, to distributing boxes located at suitable points around the main office.

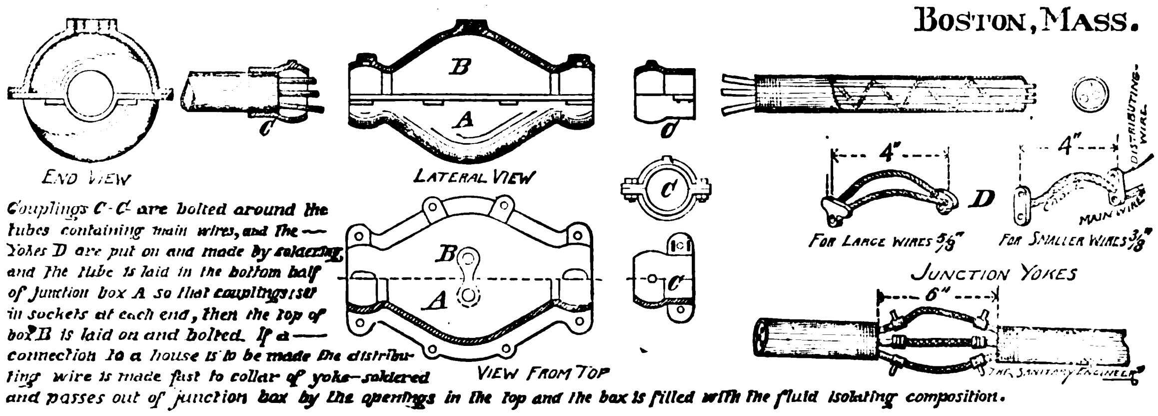


PLAN

FIG. 1.

The wires from the main office, called "feeders," are arranged in cables and laid in wooden boxes, which are filled with an insulating composition poured in hot. These wires are continuous to the main boxes, and are there connected to other wires called "mains," from which the electricity is taken off as wanted. These mains, instead of being in the form of cables, are large copper wires inserted into iron tubes 20 feet long. There are three wires in each tube (a 2½-inch tube will have three ⅝-inch wires), different sizes being used according to the importance of the district to be served. Before insertion the three wires are bound around and together with a hempen rope (see Fig. 2) to prevent all contact between the wires and with the tube; they are then inserted in the tube and the insulating material is run in.

DETAILS OF JUNCTION BOX USED ON MAINS OF THE EDISON ELECTRIC ILLUMINATING CO. BOSTON, MASS.



These 20-foot lengths are connected together by short pieces of cables inside of distributing-boxes, from which the current is carried to the consumer. At the end of each length is a coupling bolted on. The several main wires are joined separately at the boxes by yokes to which they are soldered. The distributing-wires are led off from the yokes as shown. The boxes are filled with the insulating composition.

The distributing-boxes are of cast iron, made in two sections bolted together with flanges; a special-shaped box being used to pass around corners. In the top of the box are two holes through which the wires are carried to the consumer.

As the water-mains in a well-planned water-supply are connected together so as to reduce the loss of head by friction and also to insure a supply when, by an accident or otherwise, one end of the main is temporarily disconnected with the reservoir or pumps, so these mains, after passing through their allotted districts, are joined together for a similar purpose.

One other important precaution taken by the Edison Company is to run back small wires from each main box at the end of the feeders to the central station, where they are connected to meters which show the engineer just how much tension exists in each district, or how much electricity is being used, thus enabling him to disconnect a part of

the supply from districts where few lights are being used and connecting it to districts where the most light is used and even up the pressure all around as more or less lamps are turned on.

The wire of each consumer passes through a meter on the premises, consisting of a couple of bottles of sulphate of zinc containing two zinc electrodes. The amount of zinc carried from one electrode to the other as the current passes is accurately obtained by weighing, and from it is estimated the amount of electricity used. The box containing these bottles contains also a thermostat, which, as the weather gets down to freezing, makes a connection with an Edison lamp in the box, which gives off enough heat to prevent the meter from freezing.

This company, formed early in the year, are now laying wires for a supply of 10,000 lights, and expect soon to enlarge their plant so as to supply 40,000 lights. They supply in New York some 20,000 lights, and also have plants in Chicago, Lowell, Lawrence, etc.—in all some sixty plants. They also expect to furnish small electric motors to be attached to the wires for running small machinery—lathes, sewing machines, elevators, etc.

PUMPS FOR SEWAGE AND SLUDGE AT WALTHAMSTOW, ESSEX.

WE take the following description and illustrations from London *Engineer:*

The urban sanitary district of Walthamstow contains at the present time about 32,000 inhabitants. The area being large, and some of the inhabited parts widely separated from one another, it has been a work of some time to get the whole district properly sewered, but when the present additions to the existing system are completed there will be very few houses unconnected with the main drainage. At the present time we should probably not be far wrong in reckoning that the sewage of nearly 30,000 people is treated at the works at Low Hall Farm.

The position of the farm has been so well chosen that the drainage of almost the whole parish flows down by

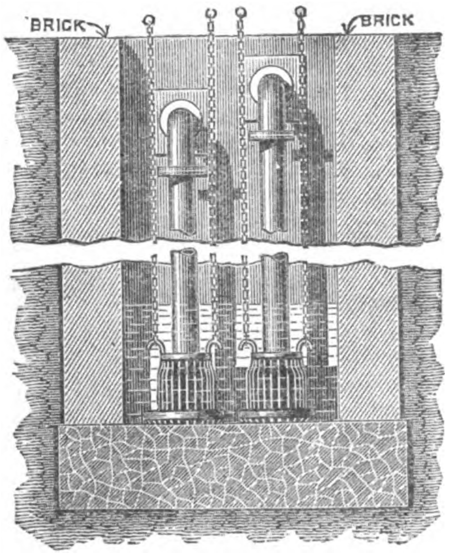


FIG 3.

DETAILS OF STRAINER IN SLUDGE SUMPH, WITH CHAINS FOR LIFTING WHEN CHOKED.

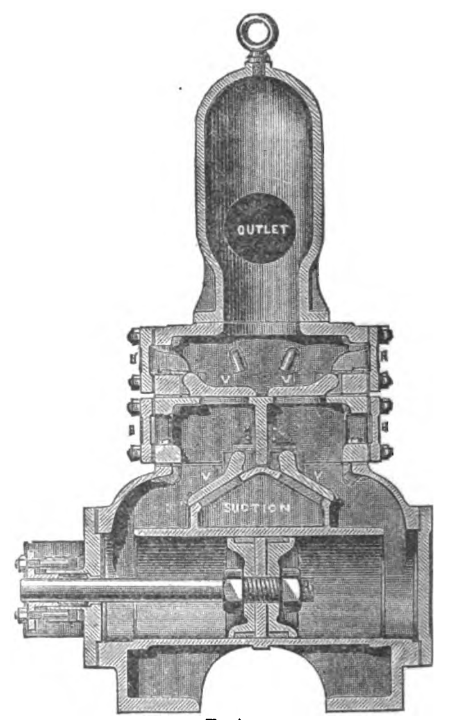


FIG. 4

FIG. 1. END ELEVATION OF PUMP

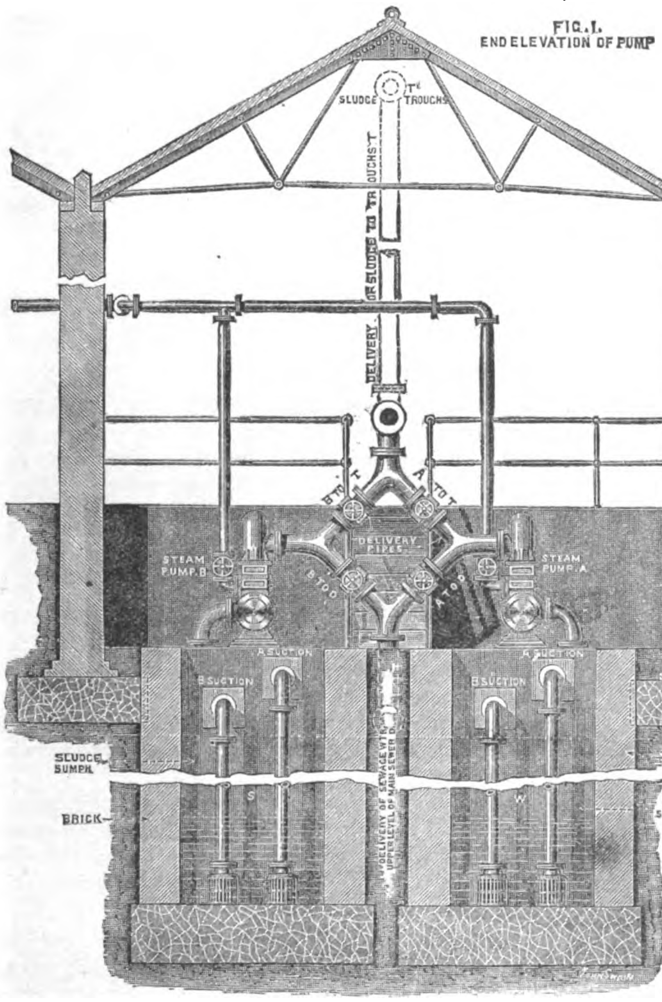
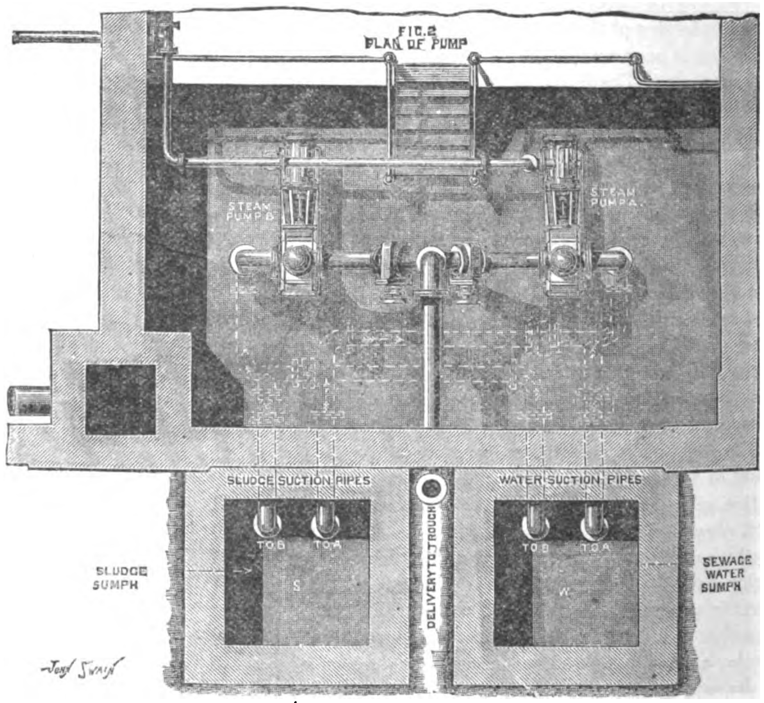


FIG. 2 PLAN OF PUMP



natural gravitation to the works, and thence, after precipitation, the effluent flows down a carrier to the land. There is therefore no question of pumping the sewage, except that from one low-lying district, which has had to be brought by a new low-level sewer, and reaches the works at W, Figs. 1 and 2, some twenty feet below the outfall of the main sewer, discharging at a rate not exceeding 10,000 gallons an hour. It was needful to arrange for raising the contents of this low-level sewer, and the surveyor determined at the same time to deal with the sludge from the settling-tanks, the accumulation of which has been a standing source of difficulty since the farm was first established, no satisfactory method of transport having been hitherto found. A wooden trough, T^1, has therefore been erected about 1,800 feet long leading from the works to a piece of ground set apart for receiving the sludge on successive panels, where it dries and is then ploughed in. To give the requisite fall for the sludge to flow down this shoot the upper end is raised about twenty-two feet above the ground-level and forty feet above the bottom of the sumph S, into which the sludge flows from the tanks in succession as they need clearing. The arrangement of steam-pumps for raising this sludge and the low-level sewage already mentioned is a very ingenious one, worked out by Messrs. Hayward Tyler & Co., under the directions of the surveyor, Mr. S. B. Jerram.

The pumps A and B, Figs. 1 and 2, and section Fig. 4 above, are of Hayward Tyler & Co.'s direct-acting type, with valves v v and v^1 v^1, Fig. 4, of peculiar arrangement suited for dealing with thick materials, the passages being unconfined, and the valves in the form of iron doors or flaps working on trunnions, each valve having by it a hand-hole, H and H^1, Fig. 4, by which it can be at once reached for clearing if it become choked with solid matter.

This form of pump has already been used by the firm with success for similar purposes at Leyton and elsewhere. The pumps are, as will be seen by the engraving, two in number, A and B, Figs. 1 and 2, placed side by side, and the suction and delivery pipes are so arranged that either pump can be set to pump either sewage-water from W or sludge from S, the former being delivered into the main-sewer outfall D, and the sludge into the troughing T, some twenty-two feet above the pump. It is very remarkable to see the way in which these pumps are able to raise the thick sludge. When the penstock leading from the settling-tank is opened the sludge flows in a thick mass about the consistency of mortar into the sumph S, and the pump raises it thence about eighteen feet by suction and delivers it further about twenty-two feet vertically to T^1. It is curious to observe the difference of sound in the beat of the valves between the pump raising the water and that raising the sludge. Owing to the arrangement of piping and valves already described, in case the sludge is insufficiently strained or so thick that the pump shows signs of becoming clogged the suction of either pump can be connected with the water-sumph W, and the valves and passages flushed out by pumping the water for a few minutes. This, however, appears not to be needful now that the arrangements shown in Fig. 3 are completed in the sumph for keeping back solids such as coke, gravel, rags, rats, etc., which hardly come under the designation of sludge. The report of the surveyor to the board meeting, after the starting of the pumps, concludes as follows: "The surveyor begs to report that about 700 tons of sludge of a dense nature have been pumped from the precipitating-beds and conveyed along the troughs a distance of 1,800 feet on to the place of final deposit without any manual labor assistance. This has been done at one-fifth of the cost under the old method." Figure 3 shows the arrangement of wrought-iron strainers in the sludge-sumph to keep back the larger solid matter from the suction-pipes. These strainers are so made that they can be lifted up for cleaning by means of chains. The boilers are of the multitubular semi-portable type, two in number.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

ENGLISH PLUMBING PRACTICE.

BY A JOURNEYMAN PLUMBER.

No. LXVI.

(Continued from page 68.)

SOIL-PIPES, ETC. (CONTINUED).

MOST of our leading London sanitary engineers consider lead to be the best material for soil pipes. It is smoother, more easily fitted to various positions, and will resist the action of sewage-gases longer than any other metal. The joints can also be made more secure, and it is easier to connect to the various fittings than any other material.

There are a few engineers who specify iron soil-pipes. The reader is requested to reread the articles on iron drains (see Vol. XI. of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, pages 82, 106, 150, 190, and 251) and also what has been written in later papers on the use of iron rain-water leaders as soil-pipes.

When iron is the material chosen for soil-pipes it should always be protected from oxidation. When possible, iron soil-pipes should be fixed on external face of walls. The writer has tested with peppermint scores of iron soil-pipes fixed on the inside of buildings, and never yet found one but what was in a leaky condition. They were all of the description shown at Fig. 1, page 83, Vol. XI., of THE SANITARY ENGINEER AND CONSTRUCTION RECORD. branch in such a way as to pass over the iron. The annular space between the two lead pipes being partly filled with oil, cement was then passed on to the end of the iron branch. An advantage of this joint is, that should it leak, it would show on the outside of the wall, and, if any bad air should escape, it would be outside the building, where it would not be so harmful as if it escaped inside.

Where lead pipes are made good to socketed iron pipes a copper thimble should be soldered on to the end of the lead pipe, and then the joint made with lead, as explained in an earlier paper when describing how soil-pipes are made good to drains.

Where an iron soil-pipe is fixed in a position exposed to the sun's rays it has been found that the expansion and contraction of the iron will sometimes cause the lead to work up out of the sockets. The writer was told the other day of a case where the lead had worked up 1½ inches out of the socket, as shown at Fig. 5, A being the lead, which was originally flush with the top of the socket. If this was the case, the joint was no longer sound, especially if only 1½ inches of lead was run into the socket. This raises the suggestion that gland-joints, with asbestos packing, so arranged as to allow for expansion and contraction, should be used where these influences are liable to exert themselves.

There are very few people in England who manufacture iron traps for water-closets, and those who do have them attached to the water-closet apparatus, with flanges, nuts, and bolts. The outlets of the traps are sometimes made good to the lead soil-pipe with flanges and screws to the floor, but more generally what is known as a cement joint is made. These joints are sometimes found to be defective, probably through the springing of the floor or vibration of the building.

It is unnecessary to weary the reader by repeating what has been written in previous papers. No matter whether

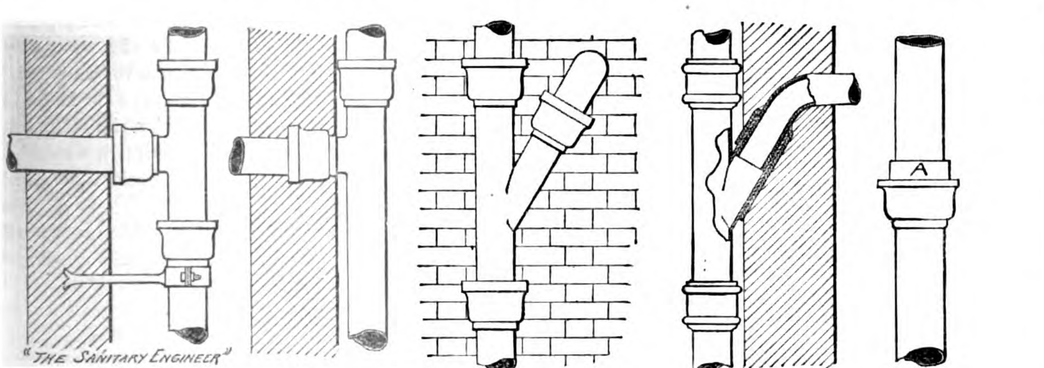


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5

Quite recently he was asked to fix an iron soil-pipe of the above description, but knowing how untrustworthy the pipes were, and the difficulty of making the joints air-tight, refused to have anything to do with the job. Some wholesale houses of business keep a heavier kind of pipe for using as soil-pipe. The section is slightly thicker than that shown in Fig. 2, page 83, in the volume above referred to. These pipes can also be had coated with black solution to prevent rusting. The writer has fixed a few stacks of this kind of pipe, but care must be taken when setting up the lead joints not to split the socket. In some large hospitals heavier pipes, similar to Fig. 3 on page above mentioned, have been used. In one case the writer has seen, the stacks of pipe are fixed on projecting brackets, clear of walls, as shown at Fig. 1. This is a very good plan, as the pipes are easily accessible all round for examination or painting. By fixing the pipes clear of the wall the branch-joints are brought nearer to the external face of the wall, so that, should they become defective, they could easily be got at for repairs. If the joints are bedded in the wall, as shown at Fig. 2, they could not be got at without taking up the water-closets and flooring for access. The evil of having a joint buried in the wall was pointed out when writing on the way skin plumbers sometimes do their work.

Figure 3 is an outside elevation showing the writer's views how these branch-joints should be arranged. This figure speaks for itself.

At the International Health Exhibition were shown some drawings of iron soil-pipes, and also branch-joints. These were arranged as shown in section Fig. 4. The iron branch had a plain end instead of a socket, and the lead pipe passed into the iron branch a few inches. Another and larger piece of lead pipe was soldered on to the lead iron or lead is used for soil-pipes, they should always be arranged and constructed in the strongest possible manner, should be protected from injury, should be thoroughly water-flushed and air-flushed, so as not to become retorts for generating noxious gases, and, above all, not to become a medium for carrying sewage-gases into the home or dwelling.

In drawing this series of papers to a close, the writer begs to thank both his American and English readers for the kind reception accorded to his efforts. He has often wished that he could have taken his tools to America and worked amongst American plumbers, so that he could have seen closely into the American system of working, and made his papers more interesting to American readers. But no matter on which side of the Atlantic the papers may be read, the same principles apply, and although there may be a slight difference of opinion on some of the subjects it does not affect the main principles.

Plumbing students in towns have been able to read the experience of one who is now getting an "old hand" in the trade and profit thereby. Old plumbers may not have seen anything new, or beyond what they knew before, although, perhaps, they may have been able to pick a few crumbs of information. Plumbers in country places have to thank the Editor for giving them the opportunity of knowing, through THE SANITARY ENGINEER AND CONSTRUCTION RECORD, how the best work is done in towns, and I sincerely hope that their time has not been entirely wasted when reading what has been written.

Although the main principles of these papers may be thoroughly in accordance with the opinions of advanced sanitary engineers and others who make this branch of science their profession, the writer still hopes that he has succeeded in laying before them a host of small details that are often overlooked, and which in the aggregate make or mar the most elaborately gotten up scheme of house sanitation.

As the shoemaker of old protested there was nothing like leather, so let every plumber maintain by his individual skill that there is nothing like *lead*, is the wish of, yours sincerely, JOURNEYMAN PLUMBER.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. I.

SOIL-PIPES.

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

1. Of what materials are the different kinds of soil-pipe made?

Iron and lead; sometimes wrought-iron is used.

2. Why is cast-iron used exclusively in New York City?

Because it is considered the best, and on that account the Board of Health makes its use compulsory.

3. Why is cast-iron considered the best?

Because it is stronger, more rigid, less likely to be injured than lead, and because it is also cheaper.

4. What material is used for soil-pipes in England?

Almost exclusively lead. In the United States during the war the high price of lead necessitated a cheaper substitute; the advantages of cast iron were perceived, hence its use.

5. Why is lead objected to in this country?

Because it is easily injured by nails being driven into it in the walls or beneath the floor; it can be gnawed by rats, and is expensive.

6. What is meant by corrosion?

It is the process of eating away.

7. How is cast-iron pipe prepared before it is used?

It is dipped in tar or asphaltum at a certain temperature (300°) and allowed to drain. This preparation is exceedingly good, but, as a rule, the coating is somewhat imperfectly done.

8. How is this done?

Hardly necessary to say how it is done, as plumbers never do it, not having the necessary appliances. But the pipe should be cleaned thoroughly and dipped into the hot preparation.

9. In what lengths does cast-iron pipe come?

Usually five feet; sometimes, though, it is made longer if required.

10. Does this include the hub?

Yes.

11. Which is best, light or extra heavy pipe?

Extra heavy.

12. Why?

Because the hubs being heavier will stand calking better; it will take longer to corrode, and sand holes are less likely to go through.

13. Is it safe to use light pipe?

Unless great care is taken light pipes will hardly resist the strain, and the wear and tear, and, except in certain places, it should be dispensed with.

14. What should be the weight per foot of 2, 3, and 4 inch cast-iron pipe?

Two-inch 5½ lbs., 3-inch 9½ lbs., 4-inch 13 lbs. per foot × H.

15. What should be the weight per foot of 5 and 6 inch pipe?

Five-inch 17 lbs., 6-inch 20 lbs.

16. Give the thickness of 2, 3, 4, 5, and 6 inch cast-iron pipe, in five feet lengths, with hub and spigot?

About $\underbrace{\tfrac{1}{4}''}_{2,\ 3,\ 4,}$ $\underbrace{\tfrac{5}{16}''}_{5 \text{ and } 6 \text{ inch.}}$

17. What is an important consideration in the strength of cast-iron pipe?

That it should be cast truly—that is, properly centered.

18. Is there any way of testing the uniform thickness of soil-pipe?

Yes, by a special callipers.

19. What is meant by sand holes and flaws?

Small bubbles formed by air or gases that generate in the mold and force themselves through the melted metal.

20. Which end of a pipe should be uppermost? and why?

The hub end for convenience in calking; also, because that is the proper line of the pipe to carry off water.

21. What are the best supports for pipes?

Brackets, hangers, or hooks, heavy; occasionally upright supports are used with excellent effect.

22. Where should the supports be placed, and how far apart in vertical and horizontal pipes?

Under each hub, and that means five feet from one support to another.

23. Describe how cast-iron pipes should be calked at the joints?

Properly picked oakum is twisted into a string and forced into the hub with an iron, then the melted lead is poured in until hubs are filled. The joint is then properly calked.

(TO BE CONTINUED.)

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith, and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

THICKNESS OF CAST-IRON WATER-PIPE.

PHILADELPHIA, PA., January 3, 1887.

SIR: The following table has been used by us for several years. It is by Isaac S. Cassin, Hydraulic Engineer of this city, and is regarded as reliable.

Respectfully, UNION HYDRAULIC WORKS.

Thickness of Metal and Weight per length of Pipe, including Bells, under Heads of Water from 50 feet to 400 feet.

Size, Inches.	50 Ft. Head		100 Ft. Head		150 Ft. Head		200 Ft. Head		250 Ft. Head		300 Ft. Head		350 Ft. Head		400 Ft. Head	
	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.
2	.2954	41½	.2994	42	.3034	43	.3074	43½	.3114	44	.3154	44½	.3194	45¼	.3234	46
3	.3292	139	.3352	142	.3412	145	.3472	148	.3532	151	.3592	156	.3652	159	.3712	163
4	.3580	198	.3660	203	.3740	208	.3820	213	.3900	218	.3080	226	.4060	232	.4140	238
6	.4069	321	.4189	342	.4309	352	.4429	364	.4549	375	.4699	390	.4789	400	.4909	411
8	.4488	482	.4648	500	.4808	519	.4968	538	.5128	555	.5288	582	.5448	600	.5608	620
10	.4862	640	.5062	676	.5262	703	.5462	739	.5662	760	.5862	799	.6062	828	.6262	856
12	.5204	828	.5444	869	.5684	908	.5924	949	.6164	1002	.6404	1042	.6644	1073	.6884	1123
14	.5521	1064	.5801	1119	.6081	1175	.6261	1232	.6641	1289	.6921	1346	.7201	1403	.7481	1460
16	.5820	1277	.6140	1350	.6450	1423	.6780	1496	.7100	1569	.7420	1642	.7740	1715	.8060	1788
18	.6102	1502	.6462	1596	.6822	1688	.7182	1781	.7542	1874	.7902	1966	.8262	2060	.8622	2153
20	.6372	1830	.6772	1949	.7172	2067	.7572	2186	.7972	2307	.8372	2428	.8772	2548	9172	2669
24	.6878	2247	.7358	2408	.7838	2572	.8318	2735	.8798	2899	.9278	3063	.0758	3227	1.0238	3441
30	.7577	3243	.8177	3506	.8777	3771	.9377	4036	.9977	4303	1.0577	4573	1.1177	4840	1.1777	5110
36	.8220	4005	.8940	4369	.9660	4732	1.038	5096	1.110	5459	1.182	5823	1.254	6186	1.326	6550
40	.8624	4664	.9424	5111	1 0224	5559	1.1024	6006	1.1824	6454	1.2624	6901	1.3424	7349	1.4224	7794
48	.9388	6080	1.0348	6722	1.1308	7364	1.2268	8006	1.3228	8649	1.4188	9291	1.5148	9932	1.6108	10575

The 2-inch Weights are for 6-feet lengths, and all others are 12 feet 4 inches long, including bells. All cast vertically in dry sand.

ROOF CONSTRUCTION OF THE DEER ISLAND HOSPITAL.

NEW YORK, January 3, 1887.

SIR: I notice in your edition of November 3 a cut of a rather remarkable roof construction for the Deer Island Hospital.

I would like to inquire what the behavior of this roof has been. Inspection shows that there is nothing to prevent the 2x8-inch collar-beam sagging under the pull of the inclined rafter-tie and the thrust of the short strut above, except its own transverse strength, and to some extent the tranverse strength of the 2x8-inch rafter, 24 feet long.

The strut, by the way, does not seem to have been intended as such, as it is only one inch thick, and, consequently, only well fitted to perform the function of cross-straining the rafter.

It would also be interesting to know whether this trussing was resorted to at every rafter, and how far apart these were.

Respectfully, ENGINEER.

[Our correspondent is undoubtedly right. The thrust of all that part of the roof lying below the collar-beam is transmitted to the latter by a pull in the inclined ties, and there is also a thrust from the inclined struts between the collar-beam and the rafters above. There is a resultant from each of these, producing a bending moment in the collar-beam which the pentagonal figure above the beam is powerless to resist. A tie from the peak to the beam is what is needed. If the rafters are sufficiently close they may be able to bear the load. The pitch is such that no great amount of snow would be likely to lodge upon the roof, and this has probably insured its freedom from destruction.]

PHILADELPHIA BUILDERS' ASSOCIATION—THE TRADE SCHOOL.

(Special Correspondence.)

PHILADELPHIA, January 4, 1887.

THE newly-formed organization of builders and those interested in the building business is still being pushed vigorously, and now it is a regular permanently organized association, stretching forth toward the field it is intended to fill. On Tuesday, December 28, the association met for permanent organization, and elected a board of directors of twenty-one members to look after the interest of the new association. Then a number of slight changes were made in their by-laws and constitution, one of which was the changing the name from the Master Builders' Association to the Master Builders' Exchange, and a committee of two, of Mr. John S. Stevens and Mr. William Harkness, were appointed to attend the meeting in Boston as representing the Exchange.

The Board of Directors of the Exchange met on December 31 and elected the following officers: President, John S. Stevens; Vice-Presidents, D. A. Woelpper, Stacy Reeves, George W. Roydhouse; Secretary, William H. Albertson; Treasurer, Charles H. Reeves; Committee on Arbitration, George Watson and Miles Ring.

The Board of Directors on Trade-School have determined to reopen their school for the months of February, March, and April. Sessions to be held on Tuesday and Friday nights, the former to be devoted to instructions in drawing and the latter to shop practice.

PLUMBING LAW VIOLATIONS.

(Special Correspondence.)

ST. PAUL, MINN., December 13, 1886.

THE Board of Public Works have had a hearing of a case in which a plumber named J. J. Dunnigan was charged with an habitual violation of the plumbing ordinance. As a result he was publicly reprimanded, the board holding also that twenty-three other plumbers in the city were guilty of the same offenses. It has been claimed that deaths from diphtheria in the residence of a gentleman named Heiniman were the direct results of Dunnigan's poor plumbing. This he persistently denies. In its remarks to Dunnigan the board gave him a severe scoring, saying, among other things:

"The awful uncertainty which may exist in your mind, of whether or not your own inexcusable, wholly unjustifiable and most reprehensible acts in habitually ignoring this ordinance may not have contributed to the cause of the death of these two young children, must be a much severer punishment than any words of ours can impose. Your offense would justify the revocation of your license, the severest punishment in the power of the board to impose; and you, sir, may consider yourself exceedingly fortunate in escaping the imposition of that penalty."

The board then passed the following:

"Ordered that each and every licensed plumber be required, within ten days from the date of the service of this order upon him, to make and return to this board a full and accurate statement, verified by his oath, of each and every job of plumbing done by him in the city of St. Paul since January 1, 1886, for which, under the provisions of the plumbing ordinance, a permit was required to be, and should have been, applied for and taken out.

"That each licensed plumber be also further required, within the said time (ten days), to make and return to this board a similar statement, verified by his oath, of each and every job of plumbing done in the city since said first day of January, 1886, for which he has taken out a permit, as required by said ordinance.

"That a failure by any licensed plumber to comply with this order will be deemed by the board a sufficient reason for refusing to grant a license to such plumber for the year 1887."

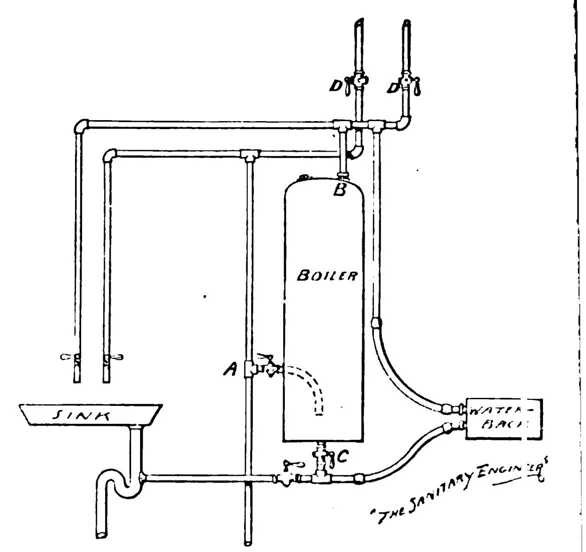
The board charges the St. Paul plumbers with an habitual disregard of the ordinance requiring them to take out licenses, and gives the following statistics:

"The building inspector states that there have been more than 3,500 buildings erected in this city during the first eleven months of the year 1886. The records of this board show that there have been twenty-four licenses granted to master plumbers since the 1st of January, 1886. The records of the building inspector show that only 497 permits for plumbing have been taken out by the licensed plumbers since January, 1886. It is incredible that, of the 3,500 buildings erected in this city during the present year, only 497 of them have had any plumbing done in them. It is more than probable that at least 1,500 of those buildings have had some plumbing done in them, for which, in each case, a permit should have been taken from the office of the building inspector. If such is the fact, then two-thirds at least of those 1,500 buildings have had the plumbing in them done in open, not to say willful, violation of the ordinance. For such a general and gross violation and disregard of a law made for public protection, can it be said that the plumbers are wholly to blame? This board thinks not."

FITTING UP A KITCHEN-BOILER AND WATER-BACK.

CHARLESTON, W. VA., December 13, 1886.

SIR: I am a reader of your valuable paper, and note your request for more reading-matter from the craft. I have just put in an old-style range-boiler in a new way to me: Putting cold water in at side A, and hot water in at top B, placing stop-cocks at A and C, that water-back and pipes may readily be drained without emptying boiler when it is not cold enough to freeze a hot boiler in one night's time. D D are stop and waste-cocks for controlling water on upper floors. I find that in this manner of



boiler fitting the circulation is perfect, no thumping or chinking, and also admits of draining pipes without emptying boiler. And we get hot water in half the time it takes the old way, as the cold water does not pass down through hot to chill it, nor does hot water have to pass through the cold to reach the proper place of storage.

If there is any objection to this manner of boiler fitting, I would like for some member of the craft to let us hear from him. YOUNG PLUMBER.

[There is some risk of losing the water from the boiler through the cock and connection A into the street-mains should the pressure in the latter become light or be drawn off for repairs while they are in their present position as shown, or into the cellar through the stop-waste should the stop be closed. A steam-pressure would also drive the water from the boiler by the same connection, and unless there is a hole in the side of the inside pipe, which drops to near the bottom of the boiler, the water may be driven so low as to allow the water-back to be burned. We would prefer to introduce the cold water to the boiler in the usual position. Otherwise we consider the scheme a very good one, and can see no objection unless it would be the possibility of some one's leaving the cock C closed when fire is in the range.

As our correspondent invites criticism, we will be glad to give space for letters from our readers who see other objections.]

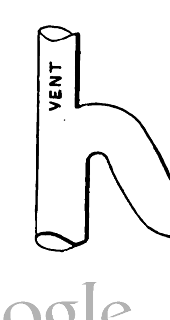
PROPER WAY OF CONNECTING VENTS TO TRAPS.

BOSTON, December 30, 1886.

SIR: I have from time to time been much interested in reading the articles on English Plumbing Practice, by a "Journeyman Plumber," particularly his last one, page 67, Vol. 15. In my own experience I have found just such a difference in the odor as the author mentions. This I found after much observation to be entirely caused by connecting the vent-pipe on the dome of the trap, which, to my mind, is bad practice, as part of the foul air which is constantly rising through the vents gets condensed and drops back into the water in the trap. In a few hours this water will smell horribly, and the emanations rise again to the roof, and smell very much like the drip from illuminating gas, which is as unpleasant and more disagreeable to the smell than drain-air. Make the connection with the traps so that the drip from the vent will not drop into the water, then not only the water will not be fouled, which causes so much uneasiness and anxiety, and that oft remark, "Oh, that closet you put in my house smells terribly!" will be seldom used, and the difference of intensity on the roof will not exist. J. T.

P. S.—This is the way I would arrange the vent.

J. T.



OHIO STATE SANITARY ASSOCIATION.

THE fourth annual meeting of the Ohio State Sanitary Association will be held in the Board of Trade Room, City Hall, Columbus, O., on February 10 and 11. The following papers will be presented and discussed:

"The probable results of sanitation one hundred years hence," by D. J. Snyder, M. D., Scio, O.; "A scientific standard for the safety of illuminating oils," by D. H. Beckwith, M. D., member of the State Board of Health, Cleveland, O.; "The cause of deafness and blindness, with special reference to the eruptive fevers," by S. L. McCurdy, M. D., Surgeon for the Penna Co., Dennison, O.; "Cremation of the lower animals," by E. S. Rickets, M. D., Portsmouth, O.; "Water-closets and privy-vaults," by John McCurdy, M. D., Youngstown, O.; "Injurious gases," by David O'Brine, M. E. M. Sc., M. D., Assistant Professor of Chemistry, Ohio State University, Columbus, O.; "Our fever epidemic from drinking sewage," by C. E. Kurz, M. D., Bellaire, O.; "The sanitary condition of Sandusky before and after the completion of water-works and a sewerage system," by Elwood Stanley, M. D., U. S. Marine Hospital Service, Sandusky, O.; "The plumber's role in the sanitary drama of the day," by E. A. Futerer, Esq., master plumber, Columbus, O.; "Syphillis from a sanitary standpoint," by C. E. Beardsley, M. D., Ottawa, O.; President's annual address, by H. J. Herrick, A. M., M. D., Professor of State Medicine and Hygiene, Western Reserve University, Cleveland, O.; "School sanitation," by Hon. LeRoy D. Brown, Ph. D., Ex-State School Commissioner, Hamilton, O.; "Some of the practical results of our criminal laws, from a sanitary standpoint," by R. Harvey Reed, M. D., Mansfield, O.; "Diagnostic responsibility," by H. M. Lash, M. D., Athens, O.; "The results of a mistaken diagnosis and its consequences in loss of life and financial paralysis," by Thomas W. Gordon, M. D., Georgetown, O.; "Examination of air of apartments," by Curtis C. Howard, M. C., Professor of Chemistry, Starling Medical College, Columbus, O.; "Hygiene of the sick room," by F. C. Larimore, M. D., Mt. Vernon, O.; "The sanitary condition of the city of Mexico, from personal investigation," by E. D. Shreve, C. E., Bucyrus, O.; "The plumber's plea for representation on the State Board of Health," by William Halley, master plumber, Columbus, O.; "Ptomaines and poisoning by tainted foods," by J. U. Barnhill, B. S., M. D., Lecturer on Toxicology, Columbus Medical College, Columbus, O.; "The relation of climatic changes to certain diseases, with chart illustrations," by E. M. Mark, Esq., Secretary Ohio Meteorological Bureau, Columbus, O.; "The chronic insane under county care, and in the care of families," by F. H. Darby, M. D., Chairman of Sanitary Committee, Morrow, O.

Reduced rates have been secured on all lines centering in Columbus, and will be granted to all persons desiring to attend the meeting, who, on application to the Secretary at least one week prior to the time of the meeting, will be furnished with the proper certificates, which *must* be secured before leaving home.

AN ACT TO PROTECT THE PURITY OF INLAND WATERS.

COMMONWEALTH OF MASSACHUSETTS.

[Chap. 274.]

Be it enacted, etc., as follows:

SECTION 1. The State Board of Health shall have the general oversight and care of all inland waters and shall be furnished with maps, plans and documents suitable for this purpose, and records all of its doings in relation thereto shall be kept. It may employ such engineers and clerks and other assistants as it may deem necessary: *provided*, that no contracts or other acts which involve the payment of money from the treasury of the Commonwealth shall be made or done without an appropriation expressly made therefor by the general court. It shall annually on or before the tenth day of January report to the general court its doings in the preceding year, and at the same time submit estimates of the sums required to meet the expenses of said board in relation to the care and oversight of inland waters for the ensuing year; and it shall also recommend legislation and suitable plans for such systems of main sewers as it may deem necessary for the preservation of the public health and for the purification and prevention of pollution of the ponds, streams and inland waters of the Commonwealth.

SEC. 2. Said board shall from time to time, as it may deem expedient, cause examinations of the said waters to be made for the purpose of ascertaining whether the same are adapted for use as sources of domestic water-supplies or are in a condition likely to impair the interests of the public or persons lawfully using the same, or imperil the public health. It shall recommend measures for prevention of the pollution of such waters and for removal of substances and causes of every kind which may be liable to cause pollution thereof, in order to protect and develop the rights and property of the Commonwealth therein and to protect the public health. It shall have authority to conduct experiments to determine the best practicable methods of purification of drainage or disposal of refuse arising from manufacturing and other industrial establishments. For the purposes aforesaid it may employ such expert assistance as may be necessary.

SEC. 3. It shall from time to time consult with and advise the authorities of cities and towns, or with corporations, firms, or individuals either already having or intending to introduce systems of water-supply or sewerage, as to the most appropriate source of supply, the best practicable method of assuring the purity thereof or of disposing of their sewage, having regard to the present and prospective needs and interests of other cities, towns, corporations, firms, or individuals which may be affected thereby. It shall also from time to time consult with and advise persons or corporations engaged or intending to engage in any manufacturing or other business, drainage or refuse from which may tend to cause the pollution of any inland water, as to the best practicable method of preventing such pollution by the interception, disposal or purification of such drainage or refuse: *provided*, that no person shall be compelled to bear the expense of such consultation or advice, or of experiments made for the purposes of this act. All such authorities, corporations, firms and individuals are hereby required to give notice to said board of their intentions in the premises, and to submit for its advice outlines of their proposed plans or schemes in relation to water-supply and disposal of drainage or refuse. Said board shall bring to the notice of the Attorney-General all instances which may come to its knowledge of omission to comply with existing laws respecting the pollution of water-supplies and inland waters, and shall annually report to the Legislature any specific cases not covered by the provisions of existing laws, which in its opinion call for further legislation.—[*Approved June 9, 1886.*

WORK AMONG THE POOR IN NEW YORK TENEMENTS.*

UNDOUBTEDLY the part of the last report of the New York Society for Improving the Condition of the Poor which will be read with most interest is the report on the Big Flat, on Mott Street—a daily record of what he saw by a disguised agent of the Society. This part of the report has already attracted much attention, and been the basis for several articles in the daily press on the need of reform in the methods of dealing with tenement-houses in this city. In a colorless way, which is more adapted to the purpose of such a report, it gives a striking account of the misery in which a certain class of our population pass their lives. Very probably, and the narrative of this eyewitness shows it, much of the misery, in this case, is due to habits of the tenants, who are among the filthiest class—Polish Jews and Roumanians, with 4 natives of the United States and 31 Irish among them.' But for the sake of the decent poor, who are in danger of being pulled down to degradation, such tenements as this ought to be cleaned out. It is better, as Mr. James Gallatin remarks in his introduction, that the inhabitants of such places should suffer, in consequence of evictions enforced through the rigid carrying out of the laws, if a more worthy class can be saved from the suffering and distress. Mr. Gallatin's remedy is to so strictly enforce the sanitary laws that the landlord cannot let the building fall into its present often disgraceful condition, and, to make this investment pay him, will be compelled to have a decent class of tenants. Drive the other element into the poor-houses or out of the city.

In addition to the report on the Big Flat, the book contains the report on tenement, street, slaughter-house, and stench nuisances inspection by the Sanitary Agent, Mr. F. N. Owen; extracts from the reports of the visitors who distribute relief; and the reports of the President, Mr. James Gallatin, and the General Agent, Mr. John Bowne. Mr. Bowne's report is a very common-sense statement of the difficulties in the way of permanently relieving the distress of the poor, by providing the means and inducing the habit of self-help. He gives some plain facts on the general uselessness of sending families into the country. After a while they come trooping back after the excitements of city life, with the society out of pocket, and no good done to the recipient of the bounty.

The book is one which should be had by all who take interest in benevolent work in this city.

THE physicians of Buffalo, N. Y., have appointed a committee of five, homœopaths as well as allopaths, to report upon the reorganization of the Board of Health. Its present condition is a cause of much dissatisfaction.

*The Forty-Third Annual Report of the New York Association for mproving the Condition of the Poor, for the year 1886. Office of th Association, 79 Fourth Avenue.

GOVERNOR HILL, of this State, renews his recommendation that the State Board of Health be abolished, and a single commissioner be substituted.

A BILL has been introduced in the National House of Representatives, by Mr. Carey, to extirpate contagious pleuro-pneumonia, foot and-mouth disease and rinderpest among cattle, and to facilitate the exportation of cattle and the products of live stock, and for other purposes.

THE Brickmakers' Exchange of Detroit, Mich., is a new organization which has resolved to boycott all contractors who buy brick from outside manufacturers, and the war has been begun by attacking one of the largest contractors in the city, who has been forced to stop work on a large warehouse he is putting up.

THE Board of Health of St. Paul, Minn., has sent a circular to the physicians of the city calling their attention to the unusual prevalence of diphtheria, and asking them to report all cases of membraneous croup to the board, as the board believes similar precautions should be taken with it as with diphtheria.

THE title of the annual report of the Clerk of the Board of Health of Kansas City, Mo., for 1885, is somewhat misleading, since it contains nothing relating to the Board of Health or its work, but is confined to the vital statistics of the city. The number of deaths reported was 1,197, and the population is taken at 105,00 , giving a mortality rate of 11.4 per 1,000. The conclusion based on this by Dr. H. B. Wood, the clerk of the board, is that the city is the heathiest in the Union; the inference that we draw from it is that the population is considerably overestimated or that the deaths are not all reported

THE water-works people appear to be considerably flustered over the *Globe's* comparison of Detroit and Toronto water-works expenditure. It is all nonsense for them to say that there is any such difference in system between the two places as will account for the difference in cost. The excessive cost of lubricants in Toronto is alone sufficient to prove bad management. Here is the comparison:

	Gallons of water pumped.	Cost of lubricants for machinery.
Detroit...	8,315.023,921	$434.73
Toronto...	3,542,736,400	1,604.15

That is, Detroit pumps 2½ times as much water as Toronto, yet Toronto uses nearly four times as much grease as Detroit. There is apparently reason to believe that there is something else greased as well as the machinery.—*Toronto Globe.*

PRICES FOR FOOD.

THE tables of the *American Grocer* show that the wholesale cost of staple articles of food were, with one or two exceptions, lower this year than in 1885. Coffee and canned goods have commanded higher prices, the advances being chiefly made in the last quarter. The variety of food was never greater; wages are good, and the buyer can get more for them than at any time in a generation past. Sugar declined 1 cent per pound; rice, 1 to 1¼ cents; tea, 2 to 3 cents; eggs, 1¼ cents per dozen; pork, $1.50 per barrel; butter has ranged from 2 to 4 cents higher per pound; cheese, 1½ cents in medium and lower grades, and canned goods from 10 to 20 per cent. higher. Flour has averaged $4.43 per barrel for straight winter wheat, being the lowest average price on record, while wheat has averaged 1 to 2 cents per bushel above the two preceding years.

A DISPATCH to the New York *Sun* says: "There are serious reasons to fear a water famine in Chicago. The reports from the "Crib" were to-day that a great deal of difficulty was being experienced in keeping the gates clear of anchor-ice, while the floating ice was also giving considerable trouble. A device was in use by which a chain was kept in motion through the gate-openings to remove the forming anchor-ice, but it formed on the gate-walls even, and the remedy was consequently only a partial success. The outside or floating ice was being chopped and pounded by the tug "Monitor," and kept away from the gates, but the task was almost herculean, for the suction incident to the rushing in of 110,000,000 gallons of water in twenty-four hours was almost irresistible. The day passed, however, without any serious mishap, without the gates becoming stopped, and without its being necessary to summon extra help from the shore."

IN the Massachusetts Institute of Technology, Architectural Department, the following mentions have been made: Monumental gateway to a city park—first mention, Messrs. Shattuck and Bigelow; second mention, Messrs. Proctor, Moore and Gay; third mention, Messrs. Parker, Carleton and Aldrich. On the Egyptian Monument— Messrs. Hodgkins and Parker received first mention; Farwell and Gay second, and Meade, Ray and Chandler third.

A PLASTER of Paris sketch of William Penn, which is to cap the dome of the Philadelphia City Hall tower when completed, has been finished. The figure will be thirty-three feet high, and the sketch is quarter size.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
January 1...	24.94	19.96	20.75	29.18	29.96	22.55	31.42

E. G. LOVE, Ph.D., *Gas Examiner.*

THE following figures concerning the illuminating gases of this city are abstracted for THE SANITARY ENGINEER AND CONSTRUCTION RECORD from the report of the Gas Examiner for the quarter ending December 31, 1886:

	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
Average Illuminating-power for the quarter...........	25.72	21.07	21.22	30.43	29.79	22.96	31.49
Sulphur, grs. in 100 cubic feet.........	4.41	15.85	17.39	4.83	4.22	4.93	3.26
Ammonia, grs. in 100 cubic feet.........	0.37	3.86	2.88	0.16	0.33	0.48	0.14
Specific gravity.....	.633	.480	.512	.733	.661	.624	.644

HEATING POWER OF NATURAL-GAS.

The Committee of the Engineers' Society of Western Pennsylvania on Natural-Gas state that "a boiler which evaporated 9 pounds of water per pound of *coal* consumed, evaporated $20\frac{31}{100}$ pounds of water to the pound of gas consumed. Taking a pound of gas to be $23\frac{1}{2}$ cubic feet (pressure not stated), this indicates a pound of gas to be equivalent to 2.2235 pounds of coal, and a pound of coal to equal in value 10.42 feet of gas." The committee further state their belief to be that with a boiler well adapted to heating by gas the value of a pound of coal would be only $7\frac{1}{2}$ cubic feet of gas.

THE electro-osteotome is the name given by Dr. M. J. Roberts to a small instrument invented by him as an aid to the surgeon in the practice of osteotomy. As first described in 1883 it consisted of a small electro-motor operated by a zinc-carbon battery, and carrying a circular saw that revolved in a plane parallel with that of the central shaft. To the end plate of the motor is attached a hollow cylinder which is covered with rubber and forms the handle of the instument. The central shaft of the motor is continuous through the cylinder, and operates the saw placed at the end of the instrument. Since 1883 the electro-osteotome has undergone some improvements. One of these consists in inclosing the motor in a tube of hard rubber. Changes have also been made in the guards which partly cover the saws. The motor is now started by a switch placed on the free end plate. The instrument has been adopted to drills and trephines, and is now provided with six sizes of circular saws. Lastly, the instrument has been provided with a small electric-light, which is operated by two cells of the battery reserved for this purpose.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE semi-monthly meeting of the American Society of Civil Engineers was held on Wednesday, January 5. The following members were elected:

For Members—Addison Connor, Assistant Engineer on the rectification of the Missouri River, Plattsmouth, Neb.; Samuel Henry Shearer, City Engineer, Indianapolis, Ind.; Frank Ormond Whitney, Assistant Engineer, City Surveyor's office, Boston, Mass.

For Juniors—Robert Cooke Clarkson, Assistant Engineer with Wilson Bros. & Co., Philadelphia, Pa.; Henry Wilson Hodge, Phœnix Bridge Co.

The subject discussed was a paper recently read by Edward Bates Dorsey, M. Am. Soc. C. E., on Irrigation. The six written discussions were submitted by H. V. Hinckley, M. Am. Soc. C. E.; Fred. Eaton, M. Am. Soc. C. E.; Edward Mead, Professor of Irrigation Engineering, Colorado Agricultural College; Henry A. Brainard, M. Am. Soc. C. E.; A. D. Foote, M. Am. Soc. C. E.; C. L. Stevenson, C. E. An abstract of this description will be given in a subsequent issue.

EXHIBITION OF DRAWINGS.

THE exhibition of drawings in connection with that of the Salmagundi Club will begin on Monday next. A private view for the press will be given this evening. We shall publish a critical notice hereafter.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.

THE second annual meeting will be held in the University of Illinois, at Champaign, January 26, 27, and 28. Special railway fares have been arranged for. The Secretary is Mr. A. N. Talbot, Champaign, Ill.

PERSONAL.

MR. A. M. WELLINGTON has retired from the editorial staff of the *Railroad Gazette*.

MR. W. HOWARD WHITE has assumed the position of managing editor of the *Railroad Gazette;* his private practice, however, will be continued under his general supervision at 74 Wall Street, as heretofore.

MR. S. WRIGHT DUNNING has given up active editorial work, intending to travel for the benefit of his wife's health. He will contribute to the *Railroad Gazette* much as heretofore.

MAJOR R. H. ELLIOTT has been appointed Chief Engineer of the Memphis and Birmingham Railroad.

GEN. A. L. ABBOTT, U. S. Engineers, has been elected President of the Board of Engineers, appointed by the Secretary of War to decide upon a bridge over the Mississippi at St. Louis.

COL. JULIUS W. ADAMS has been reappointed by General Newton Consulting Engineer to Department of Public Works of New York, a position from which he was removed by the late Commissioner Squire.

CHIEF ENGINEER ROBERT DANBY, U. S. N., died recently in Brooklyn. His funeral took place January 4.

JUDGE JAMES C. SPENCER has been re-elected Chairman of the New Aqueduct Commission of this city.

CAPTAIN FRANCIS V. GREENE, Corps of Engineers, United States Army, has resigned.

THE many friends of Mr. Charles F. McKim, of Messrs. McKim, Mead & White, will be pained to hear of his recent severe affliction in the death of his wife.

FREDERICK DAVIES, electrician, died in this city Tuesday morning. Mr. Davies had been connected with the development of electricity since the laying of the first successful Atlantic cable. At his death he was Superintendent of the South American Telegraph Company. He was a native of Wales.

SULLIVAN HASLETT, civil engineer, died in Brooklyn last Tuesday morning. Mr. Haslett, after studying at Harvard College and abroad, graduated with the degree of Civil Engineer from New York University. He was employed in making the original surveys for the New York, Buffalo and West Shore Railroad; was for several years division engineer for the Air Line Railroad of Connecticut, and was engaged in the construction of a bridge at Washington, D. C., and on the Boston Water-Works. Mr. Haslett was engineer of the Cincinnati, St. Louis and Toledo Railroad, and was actively engaged on the construction of the Second and Sixth Avenue elevated railroads in this city. At his death he was forty-three years old. He became a member of the American Society of Civil Engineers in 1879.

Patents.

353,081. Pressure-Regulator. William S. Patterson, Allegheny City, Pa., assignor of one-fourth to George W. Bishop, same place. Filed July 21, 1886. Issued November 23, 1886.

353,097. Water-Heater. Henry A. Tobey, Lima, O. Filed June 17, 1885. Issued November 23, 1886.

353,108. Street-Car Heater. Theodore Wiseman, Lawrence, Kan. Filed December 19, 1885. Issued November 23, 1886.

353,111. Heating Apparatus. Sterling L. Bailey, Chicago, Ill. Filed March 4, 1886. Issued November 23, 1886.

353,138. Hot-Water Heating Apparatus. Charles E. Hitchings, New York, N. Y. Filed April 15, 1886. Issued November 23, 1886.

353,154. Swivel Pipe-Coupling. Harrison S. Miller, Indianapolis, Ind., assignor of one-half to Patrick J. Freany, same place. Filed July 1, 1886. Issued November 23, 1886.

353,156. Water-Closet Tank. Antonio Ordonez y Ponce, Brooklyn, N. Y. Filed September 6, 1886. Issued November 23, 1886.

353,187. Gas-Burner. James S. Wethered, San Francisco, Cal., assignor of one-half to Isaac D. Guyer, Chicago, Ill. Filed December 17, 1885. Issued November 23, 1886.

353,216. Furnace. Charles H. Grewcox and Frederick Yeiter, Brainerd, Minn. Filed May 18, 1886. Issued November 23, 1886.

353,219. Fluid-Ejector. George Haydn, Baltimore, Md., assignor to Benjamin B. and Hiram W. Friedenwald, both of same place. Filed March 20, 1885. Issued November 23, 1886.

353,066. Ventilating-Grate. Edwin A. Jackson, New York, N. Y. Filed April 3, 1886. Issued November 23, 1866.

353,068. Valve. Joseph Janotte, Worcester, Mass., assignor of one-half to Taussaetint Treault, same place. Filed September 10, 1886. Issued November 23, 1886.

352,944. Apparatus for Purifying Water. James H. Blessing, Albany, N. Y. Filed August 19, 1886. Issued November 23, 1886.

352,797. Valve-Operating Device for Elevators. Cyrus W. Baldwin, Yonkers, N. Y., assigner to the Hydraulic Elevator Company, Chicago, Ill. Filed August 2, 1886. Issued November 16, 1886.

353,654. Vapor-Burner. Michael C. Armour and Frank G. Bielefeld, Chicago, Ill., assignors to the Adams & Westlake Manufacturing Company of Michigan, same place. Filed May 12, 1885. Issued December 7, 1886.

353,667. Steam-Generator. William P. Crater, Salamanca, N. Y. Filed March 23, 1886. Issued December 7, 1886.

353,680. Conduit or other Pipe. Daniel N. Hurlbut, Chicago, Ill. Filed August 17, 1886. Issued December 7, 1886.

353,681. Die for forming Conduits or Pipes. Daniel N. Hurlbut, Chicago, Ill. Filed August 17, 1886. Issued December 7, 1886.

353,689. Furnace-Grate. Henry Lencke, Reading, Pa. Filed September 4, 1886. Issued December 7, 1886.

353,695. Cement for use in manufacturing Stained Glass. Rebecca McKee, New York, N. Y. Filed June 1, 1886. Issued December 7, 1886.

353,699. Oscillating Water-Meter. Lewis H. Nash, Brooklyn, assignor io the National Meter Company, New York, N. Y. Filed September 22, 1885. Issued December 7, 1886.

353,700 and 353,701. Proportional Water-Meter. Lewis H. Nash, Brooklyn, N. Y. Filed January 16, 1886. Issued December 7, 1886.

353,702 Proportional Water-Meter. Lewis H. Nash, Brooklyn, assignor to the National Meter Company. New York, N. Y. Filed January 16, 1886. Issued December 7, 1886.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 7. PUBLISHED EVERY SATURDAY.

NEW YORK, JANUARY 15, 1887.
LONDON, JANUARY 29, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 140 William Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

AFTER this date the address of THE SANITARY ENGINEER AND CONSTRUCTION RECORD will be 82 and 84 Fulton Street, corner of Gold Street, New York City.

NATURAL-GAS.

WE devote the larger portion of this issue to an illustrated description of the natural-gas fields and the methods of supply, transportation, distribution, and utilization of natural-gas in and about Pittsburg, Pa. We trust this article, which we have been at considerable pains and expense to furnish, will be found of sufficient interest to justify our withholding the usual variety of matter of special interest to our several classes of readers.

The explorations made by Mr. Charles A. Ashburner and Mr. J. P. Lesley have thrown much light on the origin of the gas and the conditions under which it exists, present development showing that it exists in Pennsylvania over an area of 369 square miles through a depth of 3,000 feet of strata. Mr. Lesley says "it is undoubtedly evolved from petroleum, being the more volatile element of that fluid. Every sand rock that has yielded oil has yielded gas. The clay-luting of the under-world is so perfect—that is, the petroleum has been so nearly hermetically sealed, at great depths, by the filling in of rock cracks with clay—that even the naphthas have scarcely escaped."

The gas is only found in notable quantities in the loose and coarse sandstones; or, as in some cases, in a rock crevice probably connecting with a sandstone stratum.

Mr. Lesley says, in a paper on the subject, before the Institute of Mining Engineers:

> "I take the opportunity to express my opinion in the strongest terms that the amazing exhibition of oil and gas which has characterized the last twenty years, and will probably characterize the next ten or twenty years, is, nevertheless, not only geologically, but historically, a temporary and vanishing phenomenon—one which young men will live to see come to its natural end. And this opinion I do not entertain in any loose or unreasonable form; it is the result of both an active and a thoughtful acquaintance with the subject.

In a final note he adds: "When the natural-gas production comes to an end it seems to be safe to say that a vast manufacture of artificial gas will take its place, and that the artificial gas will be less variable in its heat-producing qualities"; and, he might have added, of correspondingly greater value.

Mr. William Metcalf, in an address before the Mining Institute, also admits the probability of an exhaustion of the supply, and says that in view of such a contingency, "the best engineering brains of all the country will be devoted to studying the most economical mode of using and utilizing the solid fuel outside of the district where natural-gas is easily obtained." That this method must be that suggested by Mr. Lesley can hardly admit of doubt in view of the cleanliness and other manifest advantages which the introduction of natural-gas has so thoroughly exemplified. As some gas-wells have flowed steadily for fifty years, the supply may last longer than is anticipated; and to secure regularity common prudence would dictate the joining together of wells, so that if one fails others will furnish the gas required.

THE ARTHUR KILL BRIDGE.

THIS subject has been brought again prominently before the public by the recent publication of a report of the Board of Engineers specially detailed to examine the site of the proposed bridge.

This board have made extensive examinations and a most thorough study of the whole subject, and as a result they report decidedly against the bridge unless there be extensive modifications in the proposed plans.

Their report states that the amount of freight annually passing the proposed site is about 6,000,000 tons, and is in excess of the whole foreign commerce cleared from the port of New York in 1885. The tows are made up five vessels abreast, and are eight vessels long, so that they are about 100 to 125 feet wide and 800 feet long.

A tow was recently reported which contained 120 vessels, and was brought through by four steamers. These statements establish the fact that this waterway is one of the most important in the whole country.

All this traffic will be forced through an opening 200 feet wide if the bridge be built as proposed, and the report states that the experience at the bridge-draw at the mouth of the Raritan River, which has draw openings of 207 feet, is very unfavorable.

It is a serious obstruction to navigation, and causes losses from delays and collisions, although but one-third as much traffic passes through it as through the Kill.

The tows always go through the Arthur Kill with the tide, and any collision would cause great damage. The board state that it is impracticable for the tows to come to anchor, as is done with the smaller ones at the Raritan draw.

They urge that if there were a natural obstruction of as great magnitude as the proposed central pier, it would be their duty to recommend its removal even at great cost. But the obstruction is not there now, and should not be placed there, in their opinion, to the injury of navigation, in order to save a few hundred thousand dollars to the railroad company.

The report recommends to the Secretary of War that the channel face of the east pier at the site proposed shall be on the Staten Island shore at the bulkhead line. That the channel span of the bridge shall give a clear opening of 450 feet. That the span next to the west be a draw with 125 feet clear opening, and that the lowest parts of these spans be at least 50 feet above mean high water.

This is the first time that the needs of commerce by this route have been clearly set forth in a public document.

The parties in interest are already at work trying to belittle the report and to make it appear that the officers of the War Department are not generally agreed on the matter.

To show that this report is in harmony with others on a similar subject, we would refer to a recent report made by Lieutenant-Colonel Henry M. Robert, of the U. S. Engineers, on the improvement of the Delaware River. According to the statistics of the report the traffic on that part of the river below Philadelphia was in 1885 not far in tonnage from that on the Arthur Kill. The tonnage above Philadelphia was something over 3,000,000 tons.

Yet the board of 1884, appointed to examine the needs of commerce on the river, recommended the formation of a channel from a point in the river near the upper part of Philadelphia to deep water in Delaware Bay, *with a least width of* 600 *feet and a depth of* 26 *feet,* with an estimated cost of $2,425,000.

The question is a very pertinent one, why should the commerce of the Delaware be fostered at this great expense, and at the same time

an artificial obstruction be unnecessarily placed in the centre of a natural channel of about the same width and a channel which has an equal commerce and a natural right to exist without hindrance ?

THE SANITARY ENGINEER AND CONSTRUCTION RECORD has more than once put itself on record as in favor of a comprehensive scheme of improvement of the natural waterways of the country. They furnish the cheapest means of communication available, and are made use of everywhere by men of moderate means. The small owners of sloops, schooners, barges, and canal-boats have, however, no lobbyists in the halls of Congress, and their rights and the public interest are in constant danger from the encroachments of the large moneyed corporations like the Baltimore and Ohio Railroad.

Managers of railway corporations too readily assume that available waterways are inimical to their interests, and their efforts are naturally to prevent waterways being made available as competitors. Our legislators, therefore, should guard with jealous care the one means which has in the past been a sure restraint upon the roads in so adjusting their charges as to prevent a diversion of the traffic. It is to be hoped that the Secretary of War will stand by the report of the Board of Engineers and that Congress will compel the railway company if they want a bridge to so construct it that it does not cripple the commerce of that important waterway.

THE DANGER OF ODORLESS FUEL-GAS.

As fuel-gas is now manufactured on a small scale for distribution through pipes in the streets of cities, and it is proposed to extend its manufacture, the necessity for stringent legislation to control the method of distribution and to forbid its manufacture, *unless it has a perceptible odor*, is made manifest by the account of the effects of the leaking of odorless fuel-gas in Troy, recently sent to us by a reliable correspondent, and published elsewhere in this issue.

ENGINEERING & ARCHITECTURE

OUR SPECIAL ILLUSTRATION.

VIEWS IN "OLD EDINBURGH."

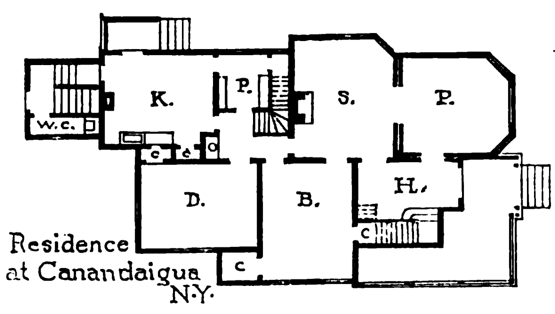
INTERNATIONAL EXHIBITION, EDINBURGH, 1886.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE AT CAMBRIDGE, MASS.—C. H. BLACKALL, ARCHITECT.

THE subject of our vignette illustration this week is a residence at Cambridge, Mass. The house is of wood, with back plastered, and the roof is of slate. The interior finishings are of cherry and oak. The house is heated by hot water, indirect radiation. Albert Morris & Co., of Cambridgeport, were the builders. Mr. C. H. Blackall, of Boston, was the architect.

RESIDENCE AT CAMBRIDGE, MASS.—C. H. BLACKALL, ARCHITECT.



WE are compelled to omit this week our usual London correspondence. The description of the work on the new Equitable Building, in this city, now appearing in the series under the title of "Builders' and Contractors' Engineering and Plant," will be resumed next week.

IT is proposed to connect Brussels with the Scheldt by a canal which will allow the passage of vessels of 2,500 tons. Arrangements have been made with an English syndicate by which the city is to pay an annual subvention of 1,800,000 francs and have a share of the profits. The city and the State can become sole proprietors after a certain period. The syndicate agrees to establish steamer lines to the chief foreign ports and to the Congo.

PARIS is also promised a better water-connection with the sea by a canal one and a half times as wide as the Suez Canal, excavated in the bed of the Seine from Paris to Rouen.

The company asks no subvention, but only the right for ninety-nine years to collect tolls on the canal and rents from the parts of the present river-bed laid dry by the proposed canal. The latter is to pass ships of 6 metres (or 19 feet 8 inches) draught.

The limit of tolls from Rouen to Paris is to be fixed at three francs per ton.

The canal follows the bed of the Seine except in two places, Elbœuf and Bezons. At the former place there will be four locks. All fixed bridges over the Seine below Paris will be furnished with draw-spans.

The chief harbors at Paris will be between St. Denis and Clichy and at Poissy, the latter to have connection with the Paris belt railway.

The canal is to be completed in three years without previous disturbances of the present navigation. The estimated cost is 110,000,000 francs.

THE canalization of the Main from Frankfort to the Rhine, at Maring, was to have been completed in October. This canal was to give a depth of 2 metres, or 6 feet 7 inches, at the lowest water, which is effected by a slack-water navigation with needle weirs and sluices. The cost was 5,500,000 marks, or about $1,375,000. It allows all Rhine vessels access to Frankfort, which has been during the construction of the canal works enlarging its harbor and railroad terminal facilities on a magnificent scale. The canal is to be operated in part by chain tow-boats, probably owing to the desirability of prolonging their run on the Rhine, for slack water navigation is not profitable for this method of towing as compared with paddle or screw boats.

ASSOCIATED PRESS dispatches from Paris, dated January 7, say that an epidemic of typhoid fever is raging at Clermont-Ferrand. Eighteen hundred out of a population of 40,000 have been attacked. There are 400 cases in the barracks. It is supposed that the epidemic was started by impure water.

THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

VIEWS IN "OLD EDINBURGH."

INTERNATIONAL EXHIBITION, EDINBURGH, 1886.

ARCHITECTURAL DRAWINGS AT THE SALAMAGUNDI EXHIBITION.

In connection with the "Salamagundi Exhibition" at the American Art Galleries in this city is given a second architectural exhibition. It is this year given under the auspices of the Architectural League, of New York. The exhibition is, as a whole, better worth seeing than last year's, and this is no faint praise. The principal interest is, as before, to be found in the varied methods of rendering used by the exhibitors. There is a lack of designs for many important constructed buildings. The principal work in this class is shown in No. 182, the plans, elevations, and some of the details for Mr. James Renwick's St. Patrick's Cathedral, which are placed on a screen at the further end of the room. Mr. Thomas O'Grady, Jr., of Boston, exhibits an interesting plan and an elevation of a Convent at Troy, N. Y., No. 150, rendered in washes after the "school" manner. The elevation deserves no particular comment, either for its rendering or design, but the plan is well rendered and well arranged, the principal feature being the Chapel, cruciform in plan, the altar in the centre, each arm of the cross being the nave of a separate chapel. The best design of completed work exhibited is that of the "De Vinne Printing House," No. 92, by Messrs. Babb, Cook & Willard, of New York, shown in two sketches, one by Mr. E. J. Meeker, and loaned by THE SANITARY ENGINEER AND CONSTRUCTION RECORD. It is a most straightforward, large, and simple structure. Messrs. Hartwell & Richardson, of Boston, present designs for several large buildings, in the Romanesque manner, of which style there are but few other examples in the exhibition. The best design for buildings, other than dwellings, exhibited by this firm is that of the "Spiritual Temple" in Boston, No. 107. Their design for a simple city house, No. 80, is good and is effectively rendered in pen and ink. "The Lawrenceville School," No. 22, by Messrs. Peabody & Stearns, of Boston, drawn by E. J. Meeker (loaned by THE SANITARY ENGINEER AND CONSTRUCTION RECORD), shows a straightforward, well-designed building. Mr. A. H. Thorp, of New York, exhibits an elevation of a circular church at Wilkesbarre, Pa., No. 149, slightly, though well rendered in pencil. The design is good and the problem interesting. It could, however, be better appreciated if the plan had been exhibited. Mr. Bruce Price's design for a church at Tuxedo Park, No. 51, is perhaps the best design shown by this architect; it is unfortunately rendered with a staringly red roof. Messrs. Rotch & Tilden, of Boston, exhibit a design for a country church at Mattapan, Mass., No. 159, well rendered in pen and ink. A seaside church, No. 71, by Mr. Henry Paston Clark, of Boston, deserves especial mention both for design and simple rendering in sepia. The designs for country churches, No. 70, by Messrs. Peabody & Stearns, are not up to the usual standard of that firm either in design or rendering. Mr. William R. Ware, of New York, exhibits his design for the American School of Classical Studies in Athens, No. 151; the drawing is rendered in a hard mechanical manner by Mr. A.D.F. Hamlin, of New York. Messrs. Rotch & Tilden's Gymnasium for Bowdoin College, No. 82, shows a good, simple design, well rendered. Among the competition drawings submitted, the most effective in rendering are those of Mr. Clarence S. Luce. His design for the Toronto Court House, Nos. 9 and 133, in heavy manner, ornamented somewhat incongruously, with Flamboyant detail, but with a well-designed tower, are excellently rendered wash drawings. They are very effective in themselves, but can hardly be considered as giving the impression of an actual construction. The perspective drawing of the Eighth Regiment Armory design, No. 41, is still more open to the same criticism, and is not as good in design as the Court House. Better in design than either of these is Mr. Lnce's Cemetery Gateway, No. 23. This is very simple and nicely balanced, with picturesque but reposeful outline. Mr. Luce exhibits an attractively rendered design for a Hotel, Lake Chautauqua, No. 19, though picturesque, it is wild in some of its detail. Mr. Bruce Price's somewhat uneasy design for the Cincinnati Chamber of Commerce, No. 91, is very well rendered in pen and ink. Messrs. Cabot & Chandler's competition design for the Algonquin Club House, No. 147, rendered by E. Eldon Deane, deserves mention. Mr. Arthur Prescott, of Philadelphia, shows a study for a city house, T Square, Club Competition, No. 167, which is rendered in a good vigorous style. Among the designs for a country house the most important is that shown by Mr. R. H. Robertson, of New York, in three preliminary sketches for the same house, No. 140. The house is designed with Romanesque motives and details, which are so difficult to use successfully in domestic work. The drawings are well rendered. The other drawings exhibited by Mr. Robertson have too little gradation in handling to be considered satisfactory. Messrs. Peabody & Stearns, of Boston, in two frames, Nos. 108 and 115, show picturesque designs for "Elm Court, Lenox," in simple washes of color, and are as effective pieces of architectural rendering as one sees in the gallery. The study for a country house, by the same firm, No. 56, is good in a different manner of rendering, but is not so good in design, the skyline of the front view being grotesquely cut by very tall chimneys. The same firm exhibits a house at Nahant, No. 55. The drawing is by Mr. Raffles Davison; it does not show Mr. Davison's peculiar mannei at its best. Mr. Bruce Price shows a design for a large house at San Francisco, Cal., No. 89, which is well rendered by Mr. Henry Neu. Possibly the best design for a country house is "House in Ohio," No. 68, by Mr. William C. Hazlett, of New York. The motive is taken from a French manoir of the time of Francis I. The drawing is simply and well rendered in pen and ink. A house by Mr. Hazlett, at Glen Ridge, is shown by a good pen-and-ink drawing; the design is good, although one might say that there were too many motives for so small a house. Mr. S. V. Stratton, of New York [in catalogue the name is printed Stanton], shows the drawing of what would be a very good house in execution, but which is an excessive example of the "imaginative" style of architectural drawing. The drawing is by Mr. Frank L. V. Hoppin, of New York. Mr. J. Calvin Stevens, of Portland, Me., shows a pretty wash drawing of a "Sketch for a Farm House," No. 92; a remarkably delicate pencil drawing of a country house, No. 21; and in "Bits in Maine" some well-rendered and prettily designed seashore cottages in pen and ink. Mr. E. M. Wheelwright's preliminary sketch for "Kelp Rock," No. 116, is a good design for a stone seashore cottage. Mr. Wilson Eyre's sketch for country house at Jenkintown, Pa., No. 112, is in the English manner, both in rendering and design, and is more pleasing than his bolder sketches, which might not unfairly be called "too bold." Messrs. Rossiter & Wright show a well-rendered perspective of a large country house, No. 154, drawn by Mr. F. A. Wright. Mr. Bruce Price exhibits a very good drawing of a design for a house near San Francisco, No. 152, in which Japanese motives are used with much cleverness. Mr. Charles E. Edwards, of Paterson, N. J., designs for houses in water color deserve mention. One of them, No. 40, however, is strangely out of drawing. Mr. Clarence S. Luce's sketches for country houses, No. 100, in water color, are very cleverly rendered. Mr. H. L. Warren's detail of an entrance porch is well drawn in pen and ink. Mr. J. W. Wells, in No. 158, shows a beautifully rendered school drawing of a bay of the façade of the Chateau d'Anet. Mr. A. D. F. Hamlin shows a well designed and rendered "school project" of an interior of a palace courtyard, No. 175. Mr. F. H. Bacon's sketches of furniture, exhibited by Mr. J. H. Davenport, of Boston, No. 17, are pen drawings of beautiful designs done in a masterly manner. The Tiffany Glass Co. show an excellent water color drawing, No. 18, by Mr. John DuFais, of a design for decoration. The same company exhibits a delicately colored design, "Sketch for a Mantel and Wall," by Mr. F. J. Wiley, No. 180. Mr. W. E. Chamberlin's colored drawing of a billiard room, No. 109, deserves careful study as an example of excellent work. Mr. Bruce Price exhibits two well rendered interiors, Nos. 10 and 87, drawn by Mr. Henry Neu. The foreign and other sketches in this exhibition form its most interesting part. Among these, easily first in interest, are the "Sketches in Athens," No. 90, by Mr. F. H. Bacon, of Boston. There is probably no man in America who can draw as truly and with such economy of line. These drawings deserve the most careful study by all who are interested in pure line drawing. Next in interest to this work comes the water-color studies of various interiors of Fontainebleau, by Mr. F. Marschall, of New York. All these are beautiful, but especially noteworthy is the rendering of the satin on the wall of a Louis XVI. room and another sketch of an old tapestry-covered chair. Mr. S. W. Mead shows five water colors, Nos. 8, 20, 24, 25, 156. All are good, but most worthy of praise are "St. Mark's Square," No. 25, and the "Porch, St. Gilles," No. 8. Mr. Louis C. Tiffany's water color of a bit from the Alhambra, No. 93, and his "Street in Cairo," No. 113, are excellent. Mr. Stanford White's "Cathedral of Laon," No. 26, a wash drawing on gray paper, enforced with brown pen-work, is a fine example of this skillful draughtsman's manner. One fails to see why the two landscape sketches by Mr. White should have been admitted into an architectural exhibition. Mr. W. E. Chamberlin shows a method similar to Mr. White's, though more peculiarly architectural, in his sketch, the "Manoir de la Houblonniere," No. 12. Mr. R. S. Peabody's "Santa Croce, Florence," No. 104, and "Nantucket," No. 39, are vigorous and good water colors. Some excellent water-color studies, etc., of decorative details from the Vatican, No. 172, are shown by Mr. A. W. Cordes, of New York. Mr. Arnold W. Brunner, of New York, shows a good bright water color of the "Tower of Agnes Sorrel, Loches," No. 75. The Porch, St. Gilles, No. 137, in pencil, by Mr. S. W. Mead, of Boston, deserves prominent mention. "The Hall Mansion, Harlem," No. 138, is well drawn in pen and ink by Mr. C. W. Stoughton, of New York. Mr. M. Landers, of New York, shows a delicate pen-and-ink sketch of an interior of a studio, No. 66. Mr. P. C. Gulbranson's sketches in Marblehead, Nos. 131 and 132, are worthy of mention. Mr. J. A. Schweinfurth's foreign sketches are good; especially so is his "Lion of Belfort of Bartholdi," No. 181. Mr. F. E. Wallis, of Boston, shows a "hot" water-color sketch of the "Palazzo Greco," which is almost identical in treatment to the same subject, No. 123, by Mr. Schweinfurth, which hangs next to it. Mr. B. D. Paine's "Street in Antwerp," No. 98, should be mentioned, as should a painstaking water-color sketch of Amiens Cathedral, by Mr. A. D. F. Hamlin. Mr. A. K. Brown and Mr. R. Brown, Jr., exhibit good water colors. Mr. R. Brown, Jr., also exhibits a good pen-and-ink drawing of an old chest, No. 179. On the staircase and in a lobby adjoining the gallery are hung a few pieces of decorative work. Mr. Frederick Crowninshield's panel painted in wax color, No. 188, deserves mention, as does a panel for a ceiling, No. 187, exhibited by Mr. George A. Glaenzer, of New York, drawn by Mr. L. Kowalski, of New York. No. 184, an Eastern Rug Panel, by Mr. Glaenzer, is a good piece of color. The Jury of the exhibition were Messrs. A. W. Drake, John DuFais, R. M. Hunt, R. H. Robertson, E. P. Treadwell, E. M. Wheelwright, Stanford White. The Reception and Catalogue Committee were Members H. O. Avery, George A. Glaenzer, and E. M. Welch.

MILWAUKEE, WIS., January 7.—Our correspondent writes: "Last Monday, January 3, 1887, a State Association of Architects was quietly formed in this city as a result of the efforts of George Terry, the State organizer of the Western Association of Architects. The following officers were elected: President, E. T. Mix; Vice-Presidents, James Douglas, of Milwaukee, and William Waters, of Oshkosh; Secretary and Treasurer, Howland Russel, of Milwaukee. The association includes about twenty architects of this city. In the rest of the State the entire number does not exceed six, only one being located in each of the principal towns. The principal object of the organization is to secure favorable legislation. Application will be made to have the mechanics' lien law amended so as to make it apply to architects. A similar movement is on foot in many other States. It is claimed that, as architects are the first to work on a new building, they should be entitled to the same protection as mechanics. The association has adopted a constitution, and will meet again a week from next Monday. The board of directors consists of the officers and D. M. Harteau, of Green Bay."

THE Architectural League of New York enjoyed their third annual dinner at the Hotel Brunswick last Monday evening, about forty being present. The after-dinner speech of the evening was by Prof. W. R. Ware, who described the foundation and progress of the American School of Fine Arts at Athens. He announced that Dr. Waldstein had consented to act as director of the school. The humorous speeches were by Mr. J. P. Riley and Mr. Fraser, of the *Century*, and the singing was by Mr. George Martin Huss.

THE third annual banquet of the Architectural Association of Minnesota was held at the West Hotel, January 4, and was attended by about fifty architects of the twin cities and a few invited guests. D. W. Millard presided. Toasts were responded to as follows: "Profession of Architecture as Viewed from the Outside," Rev. H. M. Simmons; "The Architectural Association of Minnesota," J. R. Wilson; "The Fireproof Man," G. Sidney Hounton; "Architectural Press," Mr. McLean; "The Twin Cities," F. G. Corser; "Engineering of the City of Minneapolis," Andrew Rinker. The following officers were elected: President, E. P. Bassford, St. Paul; Vice-President, George M. Goodwin, Minneapolis; Secretary, F. G. Corser, Minneapolis; Treasurer, E. E. Jeralemen, Minneapolis; Board of Managers, John F. Alty, D. W. Millard, St. Paul; W. H. Hayes, I. W. Kelley, Minneapolis.

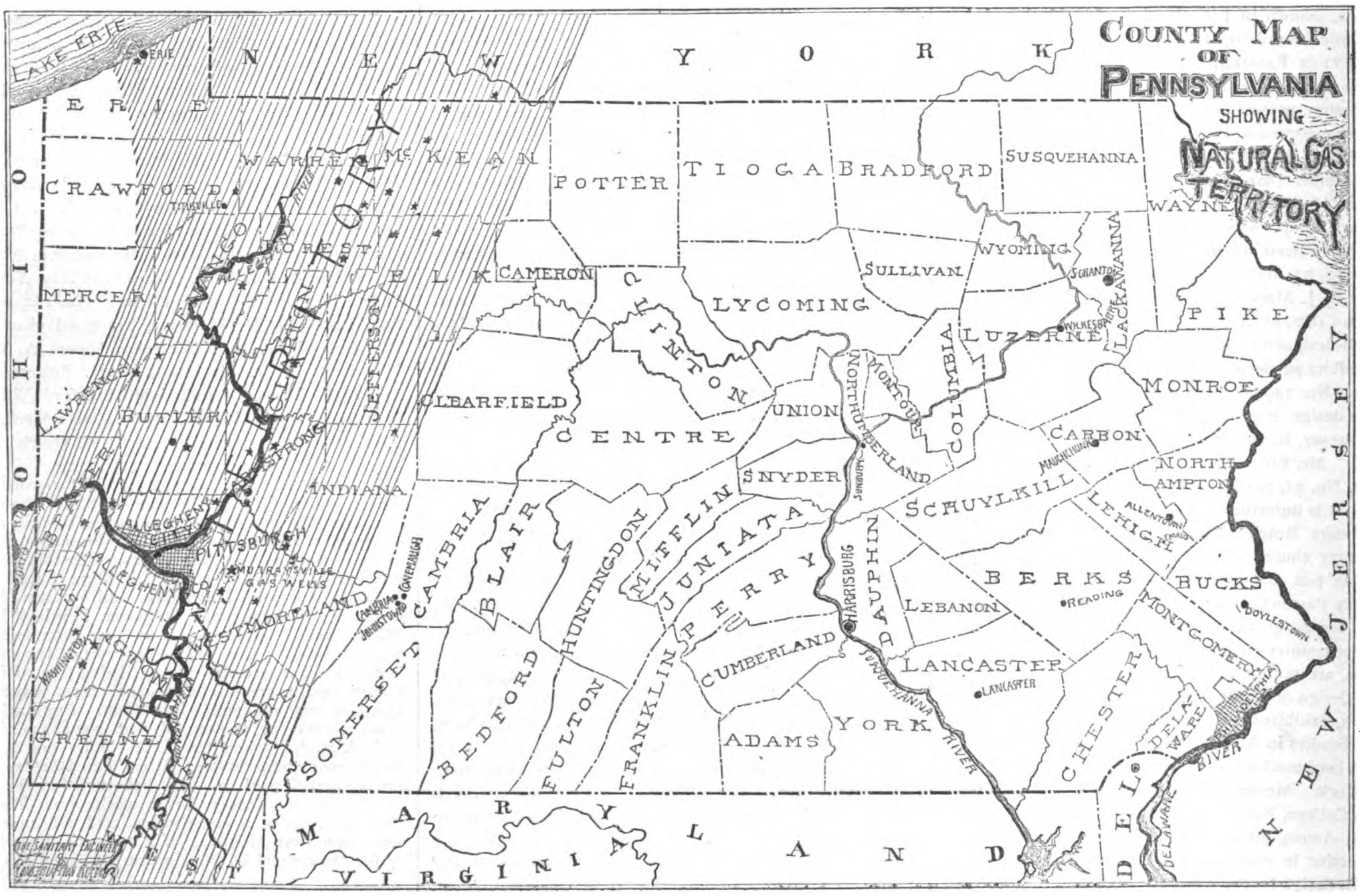
THE Philadelphia Chapter of Architects has moved to the new quarters, No. 31 South Fifteenth Street.

THE NATURAL-GAS SUPPLY OF PITTSBURG AND VICINITY.

UNDER this heading it is our intention to give such information regarding natural-gas as we obtained in a ten days' visit to Pittsburg and vicinity. The first things noticeable to one who has not been in Pittsburg for three or four years are the absence of smut compared to old times, the fact that the sun can be seen more frequently, and the disappearance of the flames from the factory and mill chimneys that used to illuminate the heavily charged atmosphere at night, lighting up the whole surroundings. This is largely changed. The state of the atmosphere is better, as is very apparent both to the casual observer by the state of his collar and cuffs and to the investigator by the state of his air-passages and expectoration. What effect it may have on the death-rate is something, presumably, yet to be determined, though our first impression is that it must be salutary and conducive to a decrease of all throat and pulmonary troubles.

Our inquiries as to what purpose natural-gas could *not* be applied to for fuel purposes, led to the reply "that in the cupola only was it so far a failure," and that iron could not be melted with it satisfactorily. The existence the commercial importance it occupies to-day, there being now over 400 miles of pipe in use, varying in size from four to thirty-two inches in diameter, supplying gas-fuel for every purpose to all in Pittsburg, Allegheny City, and neighboring towns and villages who are able to pay for it, for either manufacturing or domestic purposes, and in many cases for light.

In describing the plant for a natural-gas supply we will commence at the well and follow the gas to the burner in the best manner we can, showing the principle involved and the general manner of collecting, conveying, and distributing; not being able, however, to go into details of all the plants, as they are almost as various as their owners, there being nothing from preventing a man from drilling a well on his farm and piping it to the nearest town and selling it, except money to carry out his undertaking. The most important gas-wells yet found in Pennsylvania are in Allegheny County, at Tarentum; in Westmoreland County, near Murraysville and Grapeville; in Washington County, near Canonsburg; in Beaver County, near Baden and New Sheffield; in Butler County, near Harrisville and Butler and Lardintown; in Armstrong County, near Kittanning and Leechburg, and in almost every part of the State west pressure on the packer at the lower end of the tube and the pressure in the pipe when it is closed. To prevent this a platform, built of heavy timbers and covered with plank, is suspended by iron rods from a clamp around the casing of the well, and this platform is loaded with earth and stone to a depth of 7 or 8 feet, or until there is sufficient weight to hold the tube in the well. The weight of the derrick is also brought into use, as the floor and base are suspended from another clamp surrounding the casing of the well just above the tee. Both clamps are placed just above the fittings on the casing, so that the casing cannot be thrust through them by the great pressure from below. A *tee*-fitting is screwed on the head of the casing. From the "run" of the fitting there is carried a tube to the top of the derrick, with a stop-valve in it at easy reaching distance as shown (Fig. 1). This is called the "blow-off," and is opened to relieve the pressure on the casing should the line valve be closed. From the branch of the *tee* the pipe is carried to a separating tank shown at the right of the well. The object of this tank is to separate water or brine from the gas. The gas is blown into the tank at one end and leaves it to enter the line at the opposite end, both pipes being at the top as shown. A bottom or water-pipe



of natural-gas has been known in Western Pennsylvania, West Virginia, and Western New York since the early part of this century, and it has been used for lighting and heating in a small way in localities where it accidentally came to the surface in "gas springs" for a couple of generations or more. About the year 1841 it was found in the Kanawha Valley, in West Virginia, when drilling for salt brine, and this place lays claim to be the first to use it for manufacturing purposes, as it was used at the salt wells for evaporating the water from the salt. At a very much earlier date, however, gas was struck while sinking a well near the town of Charleston, W. Va.

With the discovery of rock-oil, however, came the discovery of gas in large quantities. It was then considered a nuisance and a misfortune for a person drilling for oil to strike gas—at least gas without oil—as there was no market for it, and operations had to be discontinued at the well or proceeded with under great difficulties and expense.

Not until 1875 was the great importance of the gas realized. In that year Spang, Chalfant & Co., iron manufacturers, of Sharpsburg, Pa., introduced it into their mills on a large scale, where they have used it ever since, and conclusively demonstrated its superiority as a fuel. It was not, however, until about four years ago that it began to assume of a line drawn from the line separating Maryland and West Virginia to the north-east corner of Kean County in Pennsylvania; and for some considerable distance west of the same continued line in New York are gas-wells and gas territory. A glance at the accompanying map of Pennsylvania will give the reader a general idea of the gas territory as now located; the stars showing the approximate positions of existing wells, and the lighter shading gas territory. Gas is also found in Chautauqua, Cattaraugus, and Allegheny Counties in New York. A gas-well is sunk in the same manner as an oil-well.

The tube or iron casing within the well is usually 5⅝ inches in diameter. This reaches to the rock to shut out water, etc. Below the tube the hole reduces to about 4 inches in diameter and is carried this size into the gas stratum.

The Gas-Well.

Figure 1 shows the head of a well in the Murraysville district belonging to the Philadelphia Co. It is typical of the manner of holding the casing in the ground, and also shows their method, in detail, of separating water from the gas before letting the latter into their lines. The heavy pressure under which the gas first issues from the ground is often enough to force the casing from the hole by the of small size is at the end of the tank low down, from which the water, brine, or other accumulation is blown out by the attendant when necessary. The tanks are made strong enough to withstand the line pressure, but a safety-valve is set on each loaded to 350 lbs. pressure, with an escape pipe to the roof to relieve the rock pressure should the line valve be closed or should the consumption of gas cease, or be interrupted, or partly so, by the shutting down of mills, etc., on Saturday afternoon.

It is usual to light the escape at the top of the derrick or at the safety-valves to prevent explosions of the gas through accidental ignition.

Pipes through the Country.

The pipes through the country districts from the wells to the points of distribution are usually 8 inches in diameter, but in the neighborhood of Pittsburg and the Murraysville district 12 and 10 inch pipe are common, many wells being connected with the large pipes. In one instance a 16-inch pipe is used. These pipes are all wrought iron, many of them being screwed joints; though some of them have special joints, the peculiarities of which will be spoken of hereafter. Within the cities 20 to 30 inch cast-iron mains are used by at least two companies—the Philadelphia Co. and Chartiers Valley Co. The other com-

panies, among which are the People's Co. (Pew & Emerson), the Mutual Gas-Fuel Co., the Baden Gas Co., the Pennsylvania Gas Co., the Manufacturers' Gas Co., the Ford & Nelson Gas Co., and the People's Natural-Gas Co., all use wrought-iron distributing-mains within the limits of size of wrought-iron manufacture, but under somewhat higher pressures.

Figure 2 will give an idea of how the wells are "ganged" in a particular location or on adjoining premises or farms for connection with the main supply. The diagram shows the scheme and the approximate positions of wells, and the numbers and positions of stop-valves. The "Dick" farm wells are a part of the Philadelphia Company's plant of the Murraysville district. We give it here as typical of similar gas-farms, simply because we were given access to their plans and permission to make drawings from them.

Special points of interest of other companies' plans wherein they differ will be treated of separately hereafter.

The Acme Wells Nos. 1, 2, and 3 were the Acme line to Bessemer (The Edgar Thompson Steel-Works.) They are now owned by the Philadelphia Co. The separating tanks of these wells differ from the others in being on their ends. The "Cooper" well and the "Dibble" supply the "Carpenter" line No. 2 to Pittsburg, and the "Campbell" well ,is a tributary. The "Deck" well, the "McWilliams" well, the "Daum" well Nos. 1 and 2, and the "Guffy" well supply Carpenter line No. 1, also to Pittsburg. The numbers have reference to the stop-valves or gates in the pipes, and the lines are so cross-connected by pipes and gates, Nos. 940, 941, 942, 943, 944, 945, and 946, that the gas from any one line may be let into any other line in case of stoppage or breakage. The distance between wells is much greater proportionately than that shown in the diagram, but this is selected as an example of what is to be found on a gas ridge, as the anticlinals of the gas territory are called. The best wells are found on the ridges, and experience has proved that gas should not be looked for in the clinales as a general thing.

The lines as they run through the country are generally buried, though now and then a small line to a mill or village is run on the ground. Long lines of pipe on the surface of the ground "creep" from differences of temperature between day and night, and are likely to leak and break. When they are buried, however, they give little trouble in this respect, the sinuosity of the lines evidently allowing for the slight changes in length that must take place. Sometimes the bed of a river is taken advantage of, as in the case of the Philadelphia Company's two 8-inch lines from Sandy Creek, in Penn township, to Thirty-sixth Street, in Pittsburg, which follow the bed of the Allegheny River.

River Crossings.

Figure 3 shows the Sandy Creek Station on the lines from Vernon, near Murraysville, which pass through Niblock and Telford on their way to the river at Sandy Creek. Two 12-inch and *one* 10-inch lines are here branched into six 8-inch lines, two of which run down the river and four across it to Hoboken, where they merge into a 20-inch line, and follow the line of the L. E. & W. R. R. to Allegheny City, supplying mills, etc., on the way. Three other crossings of the Allegheny River are made by this company alone, one of the Ohio River, and three of the Monongahela River. The one from Keystone (Pittsburg) to Twenty-fifth Street, in Birmingham (a suburb of Pittsburg), which crosses the Monongahela River, is one of the most important, and is shown in Fig. 4. A 20-inch cast-iron pipe on the Pittsburg side of the river is branched into two 20-inch pipes, each 20-inch pipe connecting with a 24-inch "header," or manifold-tee. These two tees have four 8-inch branches each, from which eight 8-inch wrought-iron pipes are carried in the bed of the river to the south shore, where they are again collected into two similar headers, and distributed to the large mills in the Birmingham district of Pittsburg. Wrought-iron pipe is used in the river, because of the ease and dispatch with which it can be laid compared to cast, because it will bend to the form of the bottom, and on account of the tightness of its joints. Trenches are dredged, and the pipe is sunk from off a scow, where it is jointed. It is anchored to the bottom by iron piles driven into the earth, and the current in a very short time fills the trenches, guarding the pipe against accident from ice. The comparatively small manifold lines carried across rivers serve also to prevent a total stoppage of the gas by an accident, for

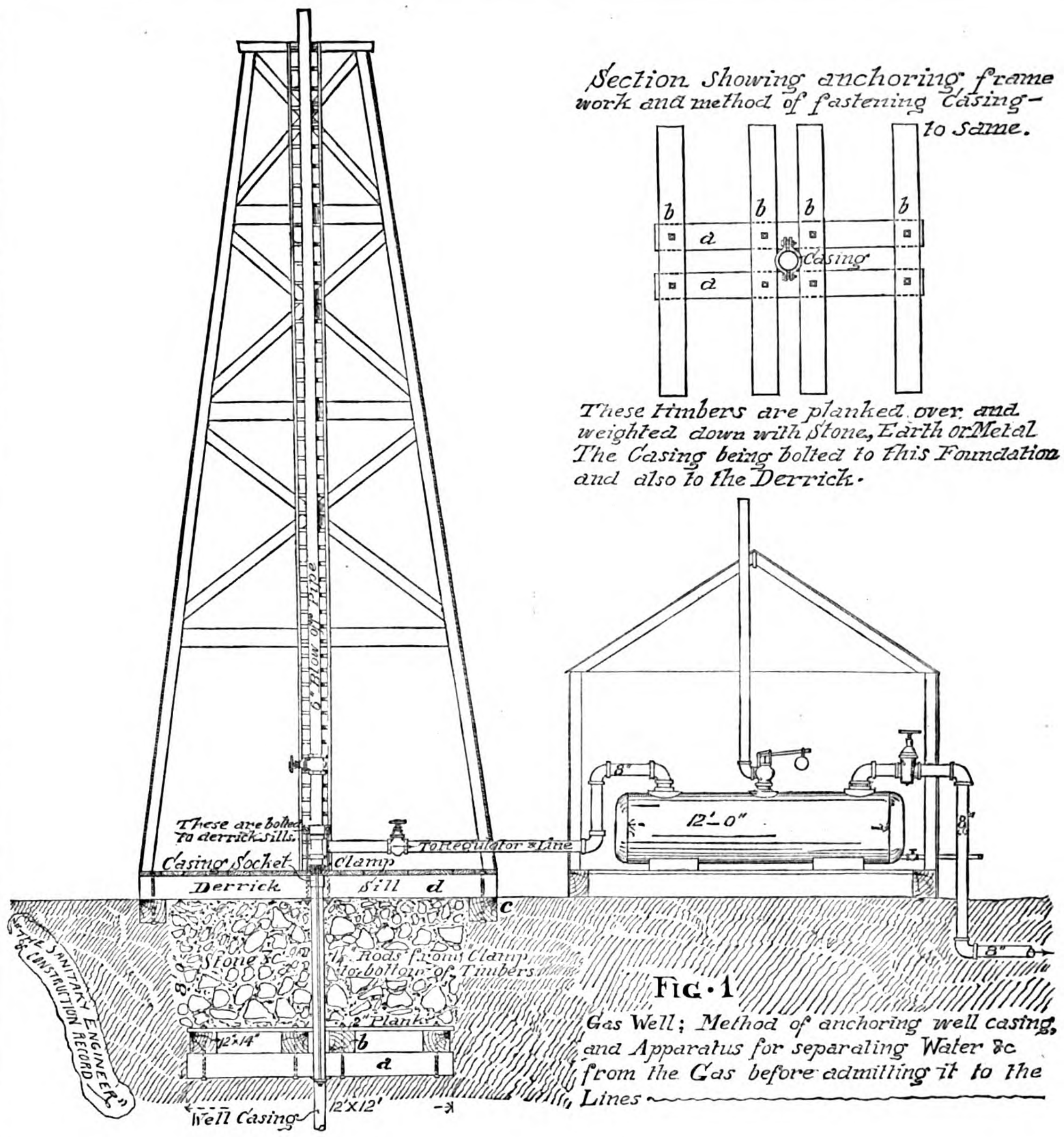


FIG. 1
Gas Well; Method of anchoring well casing, and Apparatus for separating Water &c from the Gas before admitting it to the Lines

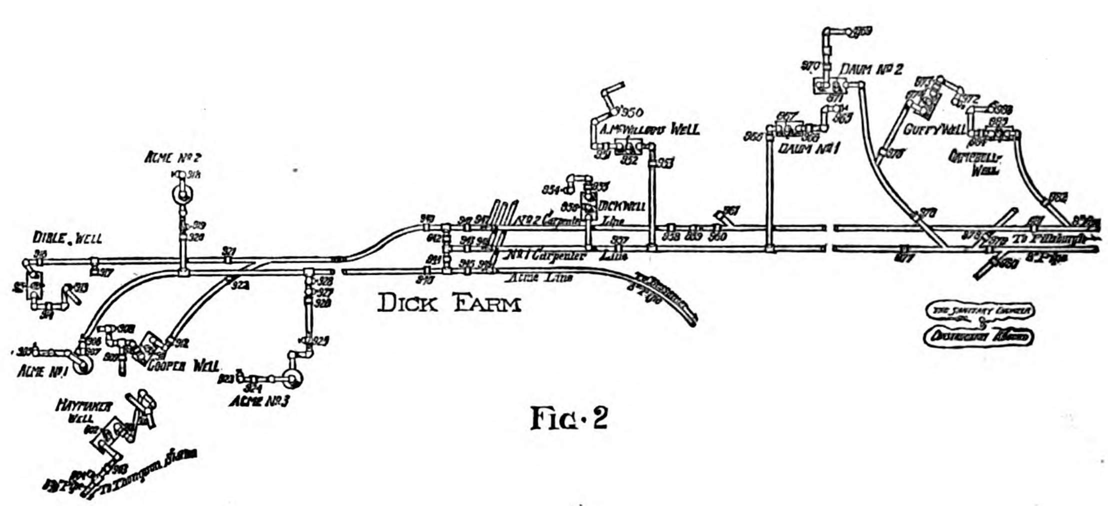


FIG. 2

SANDY CREEK

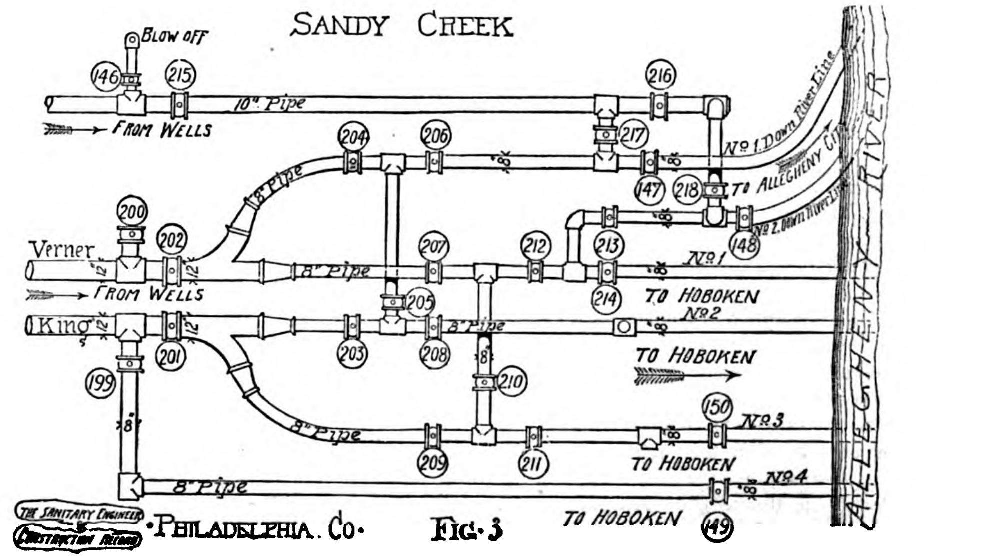


FIG. 3

should any one of the lines break, it can be closed on the banks, leaving the remaining ones to do service until renewed or repaired.

Pressures.

The pressures carried in the main lines through the country is usually all the wells will give. It may start in the neighborhood of the wells at 400 pounds per square inch, and reduce about seven pounds per mile, though of the reduction there is nothing certain, as in lines larger than eight inches the reduction is less, and depending on the amount drawn from it; but for 8-inch lines doing nearly maximum duty seven pounds per mile loss for friction, etc., seems to be about the average. Rock-pressures of 600 pounds per square inch are reported. By rock-pressure is meant the pressure that will be shown when the line is shut off at the well sufficiently long to show the maximum pressure—three or four minutes for a good well.

It becomes necessary to reduce the pressure within certain corporate limits on account of statutes governing pressure. Different companies have different methods of doing this, and fifteen pounds per square inch seems to be

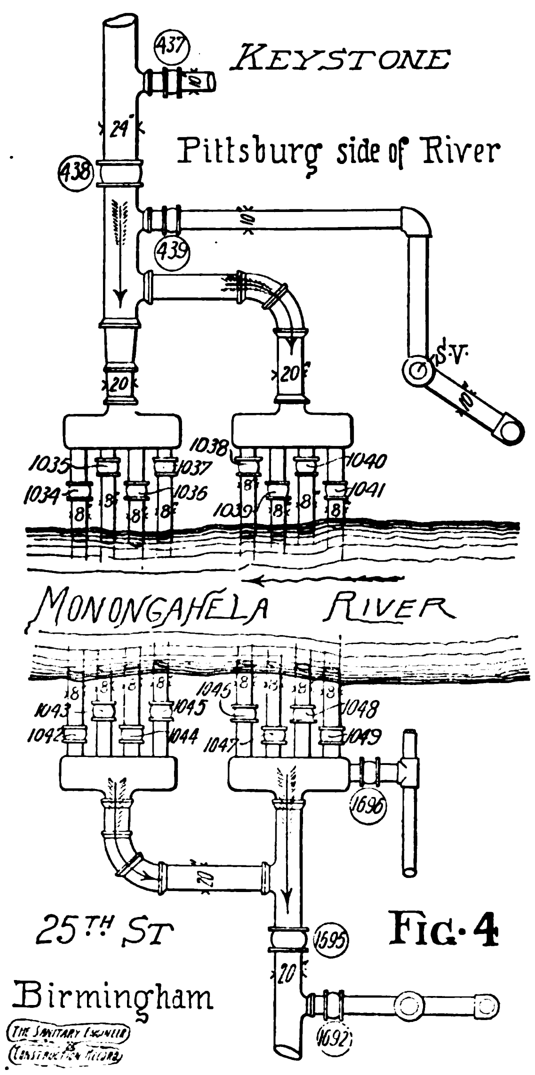
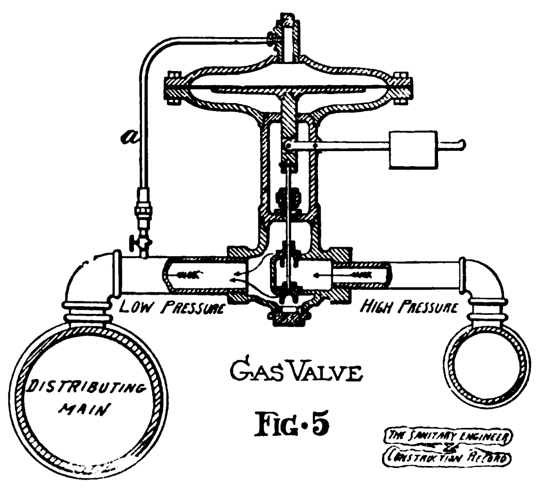


FIG. 4

the maximum pressure allowed in the distributing mains, though more frequently four to five pounds is all that is carried.

Distributing-Mains and Regulators.

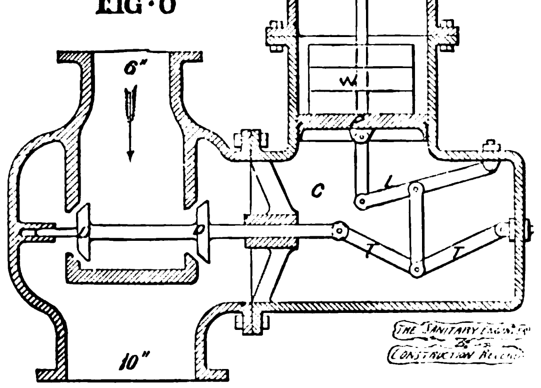
The Chartiers Valley Company have parallel high and low pressure mains in the city of Allegheny. They have a comparatively small high-pressure main with a limit of fifteen pounds per square inch in it and expand from this into large low-pressure mains to a pressure of four ounces per square inch. The latter mains will extend and encircle a block or a number of blocks of buildings, and the high-pressure mains run through certain convenient thoroughfares. The gas is admitted from the low-pressure main to the houses for consumption at 4-ounce pressure without a regulator or meter, simply through a service-cock, the rate for gas depending on the number of grates, stoves, or burners in the house, or the horse-power of a boiler or the average capacity of a furnace for manufacturing purposes. The regulator used between the high and low pressure main by this company is the "Fulton," made by Chaplin, Fulton & Co. (limited), of Pittsburg, and used very much by the companies who do not make their own specialties. This valve is shown in Fig. 5. It is a double poppet valve, the upper seat being somewhat larger than the lower one. When the pressure is admitted from the high-pressure main it raises the larger disk, drawing the under one also from its seat. When the pressure in the low-pressure main increases to what the regulator is set for (four ounces) the pressure through the pipe *a* acting on the upper side of the diaphragm closes the valves and thereafter allows it to open but sufficient to maintain the pressure of the low side, irrespective of the pressure on the high side, within reasonable limits.



GAS VALVE
FIG. 5

The Philadelphia Company use the regulator shown in Fig. 6 for reducing from the conveying lines into the distributing mains, and the one shown in Fig. 7 to reduce from the street-pressure into the house. They are the "Westinghouse" regulators. The former (Fig. 6) is placed at the corporate limits or any suitable place without them,

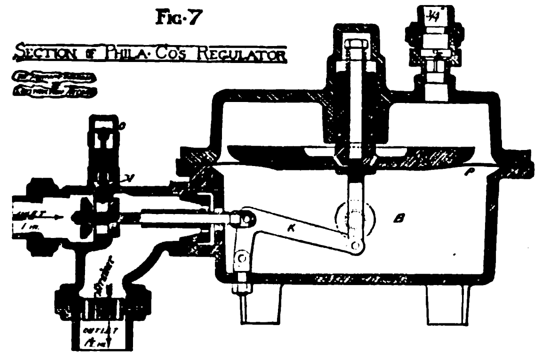
GOVERNOR FOR MAINS
FIG. 6



and the small one (Fig. 7) is placed in the service-pipe within the house, factory, or mill. The first reduces from the line pressure (?) to five pounds in the street-mains, and the latter reduces from five pounds to four or five ounces in the building, at which latter pressure it is used.

The People's Gas Company (Pew & Emerson) regulate in the manner shown in Fig. 8. Their system of pipes differ also from most of the large companies, in that they

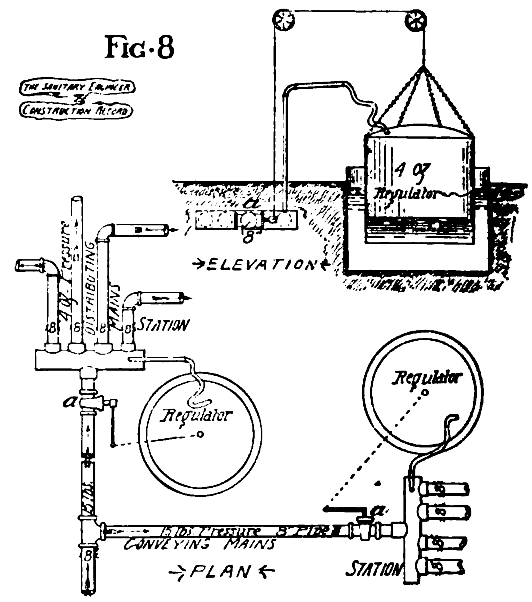
FIG. 7
SECTION OF PHILA. CO'S REGULATOR



are all wrought iron of eight inches in diameter, and that they carry fifteen pounds pressure in their conveying mains within the city limits, on account of special screwed joints, which will be described hereafter when alluding to the manner of making joints by the different companies.

The diagram Fig. 8 shows a conveying main where it branches to two different stations to be distributed. About twenty-five miles of such mains are in and about Pittsburg. A rotating valve is put into the high-pressure main at *a*, and this is connected with the well-known form of gas-regulator, shown in section at the upper part of the diagram, by the chain and pulleys in the manner shown. The lever of the valve is weighted to close the valve. When the pressure falls in the distributing mains below four ounces, the "holder" settles into the water and opens wider the valve.

FIG. 8



On an increase of pressure it rises and allows the valve to close partially and until the required balance is established, after which it moves a few inches one way or the other, according to the demand on the pipes for gas. A flexible hose connects the header with the holder. Diagram Fig. 9 shows how the Natural-Gas Fuel Company, of Butler (Butler County), regulates. The pressure in the main to the regulator is about forty-five pounds per square inch, and is reduced to three ounces for distribution. The figure at the bottom of the diagram is a section through the valve used.

PRESSURE REGULATOR

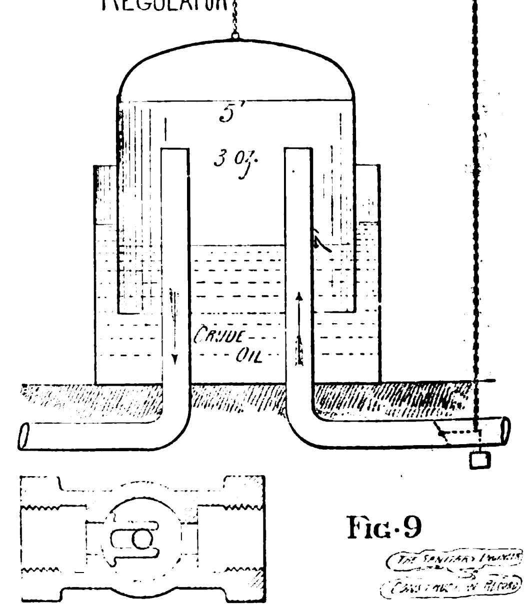


FIG. 9

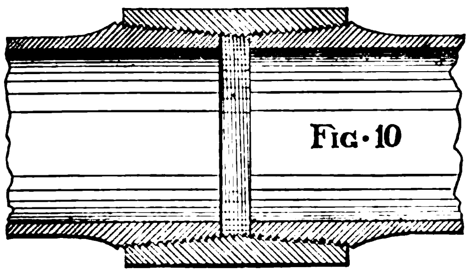
The dimensions are marked on the drawings. Crude oil is used in the lower vessel, instead of water, to prevent freezing due to the expansion of the gases, etc.

Gas-meters are not used, and are not likely to be while the wells produce copiously. One company that introduced meters and sold gas for 8 cents per 1,000 cubic feet lost business, the consumers preferring to take it at a stated price per burner, grate, or stove, preferring a certainty as to the amount to be paid monthly to what they considered the uncertainty of the meter, although the latter might be the cheaper, if proper regard were paid to the use of the gas.

Joints.

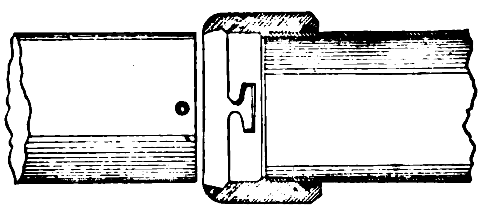
Before treating of the various methods of using natural-gas we will describe the various joints and methods of laying pipe used in and about Pittsburg; the sub-

ject being an important one on account of the difficulty of preventing leakages of gas under the high pressures used. In carrying pipes across the country where only wrought-iron is used, ordinary wrought-iron pipe with screwed threads was first adopted. This was found to be more or less defective and leaky at the joints on account of the imperfect threads and the difficulty of forcing large pipe sufficiently into the couplings by hand-power and tongs.



Fig·10

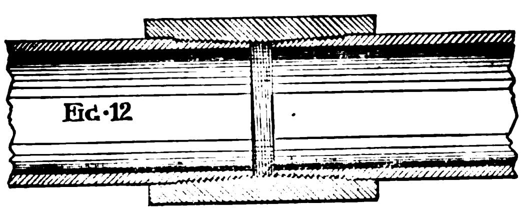
But the most serious trouble that developed, and one that could not be prevented by ordinary precaution, was the breaking of the pipes at the coupling by their being so weakened at the threads; the latter, as well known, cutting deeply into the thickness of the pipe. This brought out many devices for securing better joints; the two used for wrought-iron, which claimed most recognition on account of merit, being the "Allison" joint, shown in Fig. 10, and the "Convers" joint, shown in Fig. 11. The first is



Fig·11

made by the W. O. Allison Mfg. Co., and was invented for well casing for either oil or gas, and the latter is made by the National Tube-Works Co., and was invented expressly for gas lines.

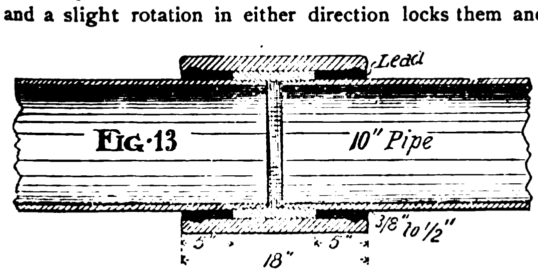
The "Allison" joint is formed by upsetting the end of the ordinary pipe in a special machine to nearly double the ordinary thickness, then threading it as shown, and using special tapered couplings threaded from opposite sides. Messrs. Pew & Emerson (People's Gas Co.) have 25 to 30



Fig·12

miles of this pipe in use, some of it under 500 lbs. pressure, and they say that they can make absolutely tight joints with it by using ordinary caution in screwing it up. The advantage they find for it in their practice is that it will remain tight indefinitely. They use it up to 8 inches in diameter.

The "Convers" joint is made in a cast-iron coupling as shown. The ordinary unthreaded ends of the wrought-iron pipe is fitted with two studs riveted into place. These studs slip within the slots and grooves in the cast coupling, and a slight rotation in either direction locks them and



Fig·13

draws them against a shoulder in the centre of the coupling. They are leaded in the usual way and calked. They are used on pipes up to 16 inches in diameter. It is claimed that this joint is elastic. It can be melted out and renewed, and it is rapidly laid down in the trenches. The Chartiers Valley Co. and the Philadelphia Co. use much of this pipe. In the crossing of rivers, however, a screwed pipe must be used, in which case the Allison pipe and joint or the "sleeve" coupling, made by the National Tube-Works Co., and shown in Fig. 12, is generally used. Either of these couplings and joints will bear bending to a very considerable extent.

A device used by the Pennsylvania Gas Co., who cross both the Ohio and Allegheny Rivers, is shown in Fig. 13. They have four lines of 10-inch pipe coming from the Washington Co. Wells with the Convers joint, but at the river crossings they use the ordinary screwed joint, over which is slipped a cast-iron sleeve, 18 inches long, with a projection of 5 inches over the coupling. This is filled with lead and calked, giving support to the thread; the inside coupling preventing the possibility of lead getting into the pipe.

After the reduction in pressures, by city ordinance, larger iron pipes became necessary on account of the amount of gas to be supplied in some localities. As 20, 24, and 30-inch pipe were required cast-iron pipe had to be employed, 16-inch being the limit of wrought-iron. It was found that cast-iron pipe could not be made tight with ordinary lead joints under high pressures, and even under the pressures of a few ounces it was found necessary to provide a means of taking away the leakage that was likely to occur at the joints from the settling of ground, differences of expansion of the metal, and the like.

Figure 14 shows in detail the joint used by the Philadelphia Co. on all pipes larger than 16 inches in diameter.

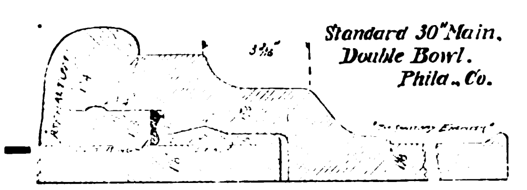


Fig. 14.

The spigot end of the pipe is as usual, but the hub end is doubled—that is, to the ordinary hub a second one larger in diameter is cast, the lead joint being made in the usual way in the first or smaller hub. A ring of cast iron to form a dam is then introduced, leaving a small space between the lead and the dam, and an asphaltum packing is then pressed into the outer hub. This is all seen in Fig. 14, where sizes and thickness of one side of a finished hub is shown. A ¾ tap-hole and pipe (not shown) is also provided to carry off leakage to a point to be burned if required.

In the work done for this company by Mr. J. H. Harlow, of the Water and Gas Works Construction Co., an air-test of 70 pounds per square inch was applied from time to time. We are informed that twice during the work tests were made by allowing the air to remain in the pipes for some considerable time. One of these tests occurred Saturday evening, and when work was stopped at night there was 69 pounds pressure in the pipe. When the men went to work on Monday morning there was still 60 lbs. pressure. The length tested was 4,000 feet of pipe 24 inches in diameter. This pipe provides for the safe disposal of any gas which may leak from the inclosed joint, but does not provide for

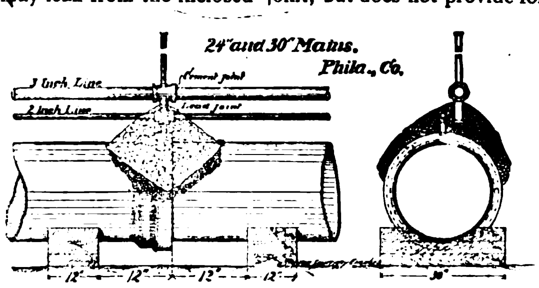


Fig. 15.

gas which may escape from the external joint, which, owing to the disturbances always to be expected in public streets, may be affected as to leak a considerable quantity at low pressure. In order to provide against the possibility of any such leaking gas penetrating through the ground into vaults or other places where it would become dangerous—which is likely to occur when the surface is closed by clay or frost—an open means of escape is provided by surrounding the joint with a considerable mass of broken stone, which, in turn, is covered by a sheet of strong tarred paper. The arrangement of this can be seen in Fig. 15. Through this tarred paper, from the mass of stone, rises a trumpet-mouthed "T," communicating with second line of escape-pipes parallel with the first and with a the main pipes, and also leading to the *lamp-post* at the sidewalk. These *lamp-posts* are discharge-pipes for the

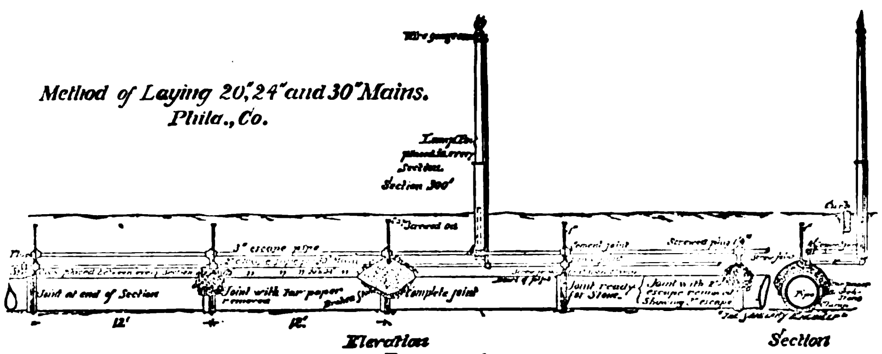


FIGURE 16.

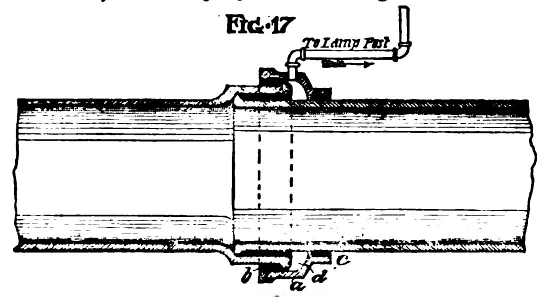
escaping gas, and are placed as nearly as may be in the middle at every section of 300 feet or less.

The drawing Fig. 16, which shows the method of laying the 24-inch and 30-inch mains, also shows the use of a separate inclosing-chamber around the joint of the cast-iron main. Where smaller wrought-iron pipes are used within the city which are to carry low pressures, the joints are inclosed in broken stone, covered with tarred paper, and one line of escape-pipes from the broken stone is laid with frequent issues to the lamp-posts, but no pipes are laid by the Philadelphia Company within prescribed limits which are not protected by one of these methods. The lamp posts are really what their name implies, for the escaping gas is often purposely ignited and maintains a flame in proportion to the quantity of leakage, generally yielding much more light than the neighboring illuminating gas-lamp. Recently the Philadelphia Company has placed lanterns on some of these posts which are kept permanently lighted.

These methods of providing against the dangers of leaking gas are the subject of a large number of patents, which, for Allegheny County, Pa., are owned by the Philadelphia Company.

Figures 17 and 18 show the methods used by the Chartiers Valley Gas Company with their large cast-iron mains.

Fig·17



Fig·18

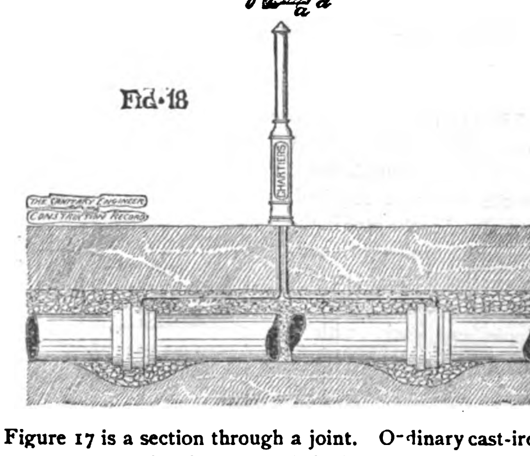
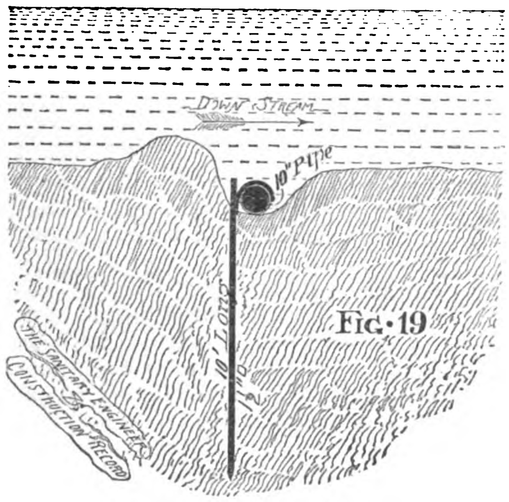


Figure 17 is a section through a joint. Ordinary cast-iron water or gas pipe is used and the lead joint made in the usual way. Then a supplementary hub, which is loose on the spigot end of the pipe, is slipped over the main hub and calked with lead at the points *b* and *c*. The chamber thus formed (*d*) is tapped on top, and an escape-pipe, ½-inch in diameter, is carried to a lamp-post and burned if the leakage warrants it. Figure 18 shows how the pipe is laid and how several such joints are carried to a single lamp-post.

The tops of the pipes in the lamp-posts are numbered to correspond with the joints in the main, so that a leaky joint can be located without digging the street.

Laying Pipes in Rivers.

The methods of laying pipe in the rivers is from a scow. A dredge goes ahead and forms a trench across the bottom of the river. The scow follows with the workmen joining the pipe, and allowing it to fill with water so that it will sink into the trench as the scow is drawn ahead. Then "pickets" or piles of iron, nine to ten feet long, made of 1½-inch square iron, with a hook on one side, are driven into the mud and earth, as shown in Fig. 19, to

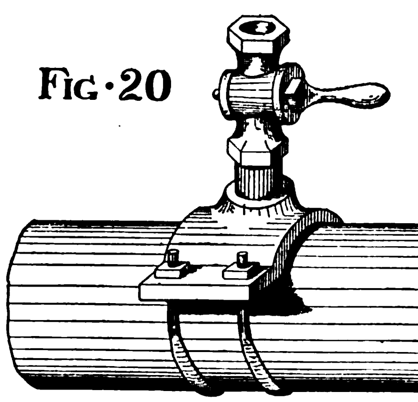


FIG·19

keep the pipe in place. The earth is then allowed to fill the trench by the current of the river, which adds additional security to the pipe and protects it from ice and the current. After all is done the water is blown out. About twenty feet is kept between parallel lines in the river at a crossing. The picket used and the method described is that of the Pennsylvania Gas Company, with wells at Canonsville, Washington County.

Telephone lines are used along the lines of pipes by nearly all the companies with stations at suitable distances, and line-walkers go over the lines at stated periods, to report any leakage or threatening damage. The stations on the Pennsylvania Gas Company's lines are 3½ miles apart, and the line-walker reports twice daily the record of pressures, etc.

FIG·20



Tapping a Pipe

Figure 20 shows how a wrought-iron main pipe is tapped to take a branch from it. A saddle of cast-iron, threaded for the size pipe required, is strapped to the pipe in the manner shown, with a suitable gasket between the pipe and the saddle. Then a nipple and cock, with a round way, is screwed into it, the hole being drilled through the way in the cock. The pressure of the escaping gas will blow the cuttings of iron from the hole. In places where the escape of gas would be dangerous, a gland or stuffing-box is used on the drill, the same being fastened to the cock. A special cock is also used with male threads, so as to avoid the use of a nipple.

How the Gas is Used.

A service-pipe is carried into the mill, house, or other building, and they vary in size from eight inches for a mill under five pounds or more pressure to a ¾-inch pipe for a small house under 4-ounce pressure. Any house-service, however, will pass more gas than is used within the house, but smaller pipes are not used, as they would be impracticable for other reasons.

The best method for using or burning the gas in the making of iron or for the arts or domestic purposes and lighting is as yet a matter of experiment, although excellent results have already been obtained by apparently crude means. It is claimed that the nearer the principle of the Siemens furnace is followed, the better in the making of iron; but of this there is no absolute *dictum*, nearly every manager or foreman of a mill of any kind imagining his own arrangement is the best, and many of them jealously guarded against giving any detail of construction of their furnaces. There are many, however, who have a high and intelligent appreciation of the subject, and are studying it closely. The best results are obtained where the gas and air are both burned at a temperature of near 1,800° Fah., the supply of each being regulated as near the combining quantities as possible. This is both in the interest of economy of gas and of improvement in manufacture. It is stated that more than a saving of one-half the cost of the coal for a steel plant is made by the use of gas-fuel, and this does not take into consideration the cost of handling the coal and ashes.

The wear and tear on furnaces of all kinds is very much reduced, and other savings are made in manufacture. It is very probable that should the natural-gas supply of this region ever become exhausted the mills would never go back to the use of coal as a fuel, but would prepare their own gas or have it prepared for them from the coal they would otherwise use, and then find it cheaper and better than using the coal in the old way.

In the making of steam the apparatus is crude, indeed, although apparently very good results are obtained. No reliable data exist as to the water evaporated for a given weight of gas, and in some cases, so far as a casual observer can see, large boilers are fired with apparently a small consumption of gas, while small ones often have a gas-flame roaring under them or through them that would terrify a stranger at the first look. This is undoubtedly due to the accidental conditions favoring combustion in the one case, the supply of air to gas being about as it should be, and the quantity of both combining being about proper for evaporation, while in the other case too much gas with not sufficient air, or an insufficient supply of the gas for the air passed, though in the latter case this is soon apparent by the dropping of the steam-pressure in the boiler. This gas, however, requires more oxygen than ordinary illuminating gas, and consequently more air, and this fact coming to the knowledge of the ordinary fireman, many of them provide for a large influx of air, and when steam begins to fall, instead of adjusting the air-supply by reducing it and noting results, they turn on more gas instead, so that waste ensues.

Gas Under Boilers.

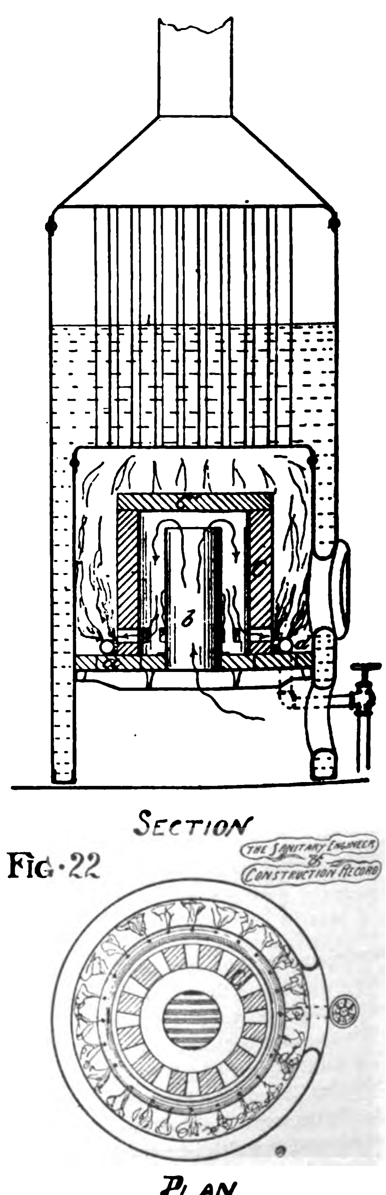
Figure 21 shows a favorite method of arranging a horizontal steam-boiler for the burning of gas-fuel. The boilers in the new Court-House are fired this way. The regular fire-grate is always allowed to remain, and in the setting of new boilers the grates are put in exactly as they would be if coal was to be the fuel. This is in case of emergency should the gas-supply be interrupted, and a few days' supply of coal is always kept on hand. The grate proper then is covered with fire-bricks on edge laid closely with fire-clay to prevent the air from passing, as at *a*. A bridge-wall is then built on the grates, as at *b*, about twenty inches from the lining of the boiler front. This is sometimes only an ordinary bridge-wall carried to within six inches of the shell of the boiler, though more often it is about as shown and carried almost tightly against the boiler, with perforation of about 3x3 inches in the alternate courses of the bricks. Then within the space between this secondary bridge-wall and the lining of the fire front a 2½-inch perforated gas-pipe, *c*, is used. As to the diameter or distance of these holes from each other there seems to be no set rule. The average distance seems to be about 2½ inches, and the holes about one-eighth of an inch.

In some cases, then, fire-bricks broken into pieces about the size of small egg or stove coal is piled on the grate underneath this pipe (*c*). The object of this brick is two-fold: First, it becomes heated, and, as it is refractory, helps to maintain the heat of the furnace and prevent radiation downward; and, secondly, the air which supports combustion is filtered through it, where it becomes warmed more or less before it reaches the gas.

In other cases the broken fire-brick is carried over and above the pipe, the gas being allowed to escape into the mass and burn amidst it, reddening the whole, which glows like a coal fire.

The air-supply to the gas is often controlled by the ash-pit door alone by fixing it ajar. A better method, however, is probably that shown in our cut (Fig. 21). The ash-pit doorways are bricked up, leaving a number of 2¾x4-inch holes as shown, into which brickbats are laid to regulate the supply of air. This is found in every case by experiment and observation at peep-holes at the rear and through the fire-door, and when once the bricks are set they are rarely moved.

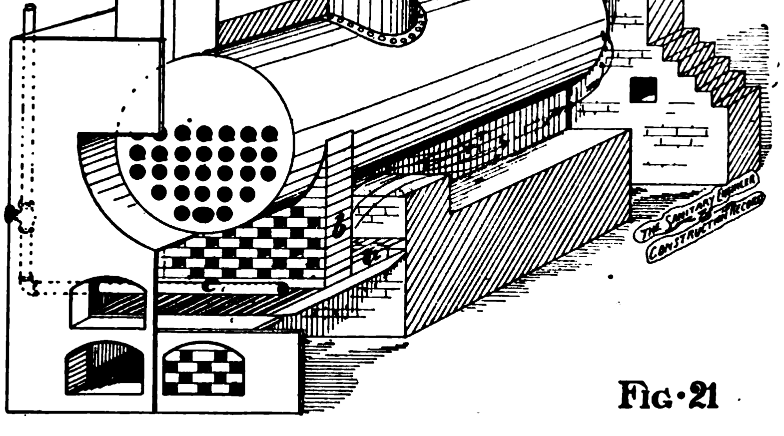
Everything is done with the view of being easily removed. Should the gas-supply be cut off, the bricks are



SECTION

FIG·22

PLAN



FIG·21

torn from the doorway, the pipe *c* uncoupled and withdrawn, the secondary bridge-wall thrown down, and the bricks removed from the grates, when all is ready again for a coal-fire.

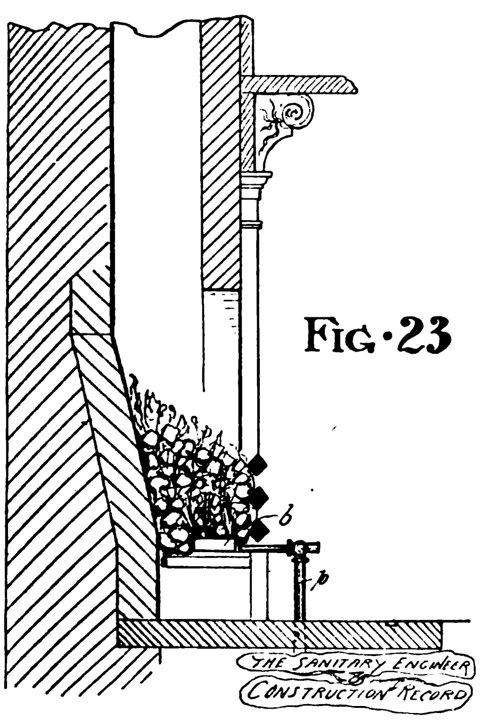
As no one seemed to know how much gas he was consuming, we were unable to approximate even the water evaporated per 1,000 cubic feet of gas for any pressure.

Figure 22 shows an arrangement for burning gas-fuel in upright boilers as constructed and used by the Kelly & Jones Company. On the regular grate is laid a fire-brick bottom (*a*), to the centre of which is attached an iron tube (*b*) extending upward about two-thirds the length of the furnace and open at the top. Around this tube is an annulus of brick-work *c*, covered with a fire-tile *c'*, and perforated at stated intervals a few inches above the bottom. The gas-ring (*d*) of 2 or 2½-inch pipe extends around this annulus within the annular space formed by the boiler. It has holes for the passage of gas which coincide with the holes through the brick annulus, the latter being for the admission of air. Pounded fire-brick is also added in some cases, which covers both the pipe and the holes in the annulus, through which the gas and air mix and burn. When the fire-brick is not used the jets are directed against the sides of the boiler-leg by the arrangement of the holes. The object of this furnace is to warm the air as much as possible in passing it in, as well as to get an equitable distribution of the heat and economy of gas. The large upright boilers in the Western Penitentiary are fired this way.

A more common way sometimes followed is simply to put an annular burner made of pipe on the grate and cover it with broken fire-bricks, allowing the gas to burn between the bricks and redden them, giving the whole the appearance of a coal-fire. This latter method is the one used altogether in coal-stoves and grates when they are changed to burn gas-fuel instead of coal.

Use in Grates and Stoves.

Figure 23 shows in a general way how a coal-grate is altered for the consumption of natural-gas. Any form of



FIG·23

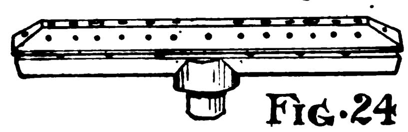
burner almost may be used, and frequently only an open-ended pipe terminates within the bed of broken bricks, but as a general thing some one of the many forms of burners which have sprung into existence for this purpose, a few of which we show hereafter, are used. The gas is simply allowed to burn among the bricks, making them very hot, and radiating much heat into the room—much more than can be obtained from a coal-fire.

In the diagram *b* represents the burner, and *p* the gas-supply pipe—a "safety-cock" or valve being used at the corner of the pipe for the purpose of controlling the supply of gas to the fire, which latter is adjustable only with a key.

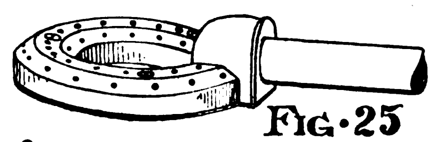
An enormous waste of heat and gas goes on in these cases, and the writer thinks the gas used in a single grate is often enough to run a 10-horse-power boiler.

In coal-stoves the method is about the same, but here the great waste apparently does not go on. A burner of about the size and shape of the bottom of the grate is put in and the fire-place filled with broken bricks or crucibles in sizes to suit the taste or judgment. Sometimes clay balls of 1¼ to 1½ inches in diameter are used in stoves or fire-places.

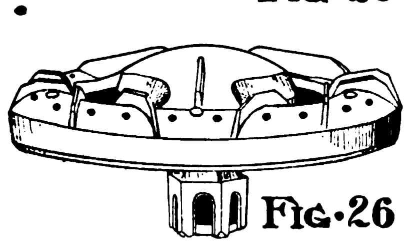
The accompanying Figs. 24 to 30 inclusive, for which we are indebted to the Natural-Gas Supply Catalogue of the Kelly & Jones Co.'s Pittsburg branch, show the forms of burners used in stoves and ranges, their sizes and



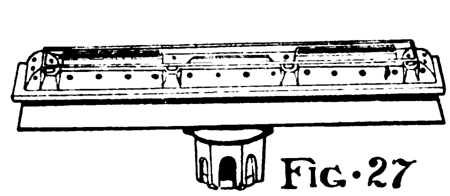
FIG·24



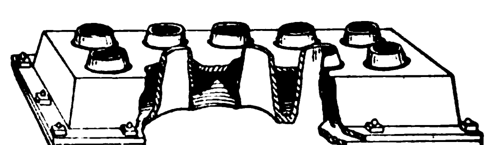
FIG·25



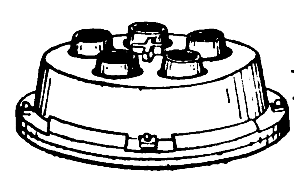
FIG·26



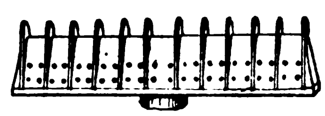
FIG·27



FIG·28



FIG·29



FIG·30

shapes being as various almost as the sizes and shapes of grates of stoves. Some of them are only an annular or rectangular chamber perforated for the passage of gas. Some, however, have the Bunsen principle involved in them, as shown in Figs. 27 and 28.

Figure 31 will give an idea of a sheet-iron heating-stove arranged entirely for the burning of natural-gas. We found it in the office of the Mutual Gas Fuel Co. at Butler. A burner of the Bunsen pattern is used at *b*, which admits a mixture of gas and air to the ring, where it is ignited and the necessary admixture of air allowed to reach it through an air-hole at *a* in the large tube. The heat of combustion therefore passes up the large tube and down the smaller ones, reaching the escape-pipe at the bottom. Warm air passes up the centre tube and escapes through the fret-work of the top, while the outside pipes act as a direct radiator. The centre pipe may be connected with external fresh air.

The charges for gas by the Butler Company are $1.50 per month for legitimate consumption through a ⅛-inch hole at 3-ounce pressure, and $2 when a $\frac{3}{16}$-inch hole is used.

When Used for Lighting.

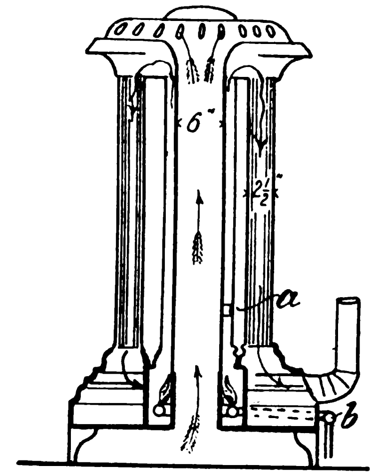
The utility of this gas for lighting purposes is not equal to manufactured illuminating gas. Its cheapness, however, induces many to use it. In stores or warehouses where it does not damage the goods it is often burned in ordinary burners, but with a great loss of light compared to coal-gas. Burners such as are used for naphtha gases also are used; the ring burner, with many little jets, apparently being a favorite. Where a good light is wanted, however, a "Siemen's Lungren" burner is used, and also one that is called a "Calcium Gas-Burner."

The average composition of Pittsburg natural-gas is as follows, according to Mr. S. A. Ford, Chemist:

Carbonic acid	.6 per cent.
Carbonic oxide	.6 " "
Oxygen	.8 " "
Olefiant Gas	1.0 " "
Ethylic Hydride	5. " "
Marsh Gas	67. " "
Hydrogen	22. " "
Nitrogen	3. " "
	100. " "

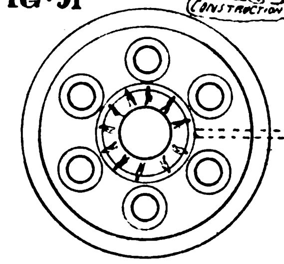
Great care must be taken with natural-gas pipes within a house. Leakage is not as easily detected by the sense of smell as with coal-gas. It is very important that the pipe-work should be carefully and skillfully done, and that none but prudent and careful and experienced workmen be employed.

The piping should be large, or comparatively so, so as not to be easily disturbed or broken, and so the pressure will be maintained at the burner-cocks. Pipes should be in flues if possible or exposed altogether, and under no consideration should they be under floors or in partitions. Their cocks should never be in confined places, but if possible where the draught of the chimney will carry any possible leakage into it. Galvanized-iron fittings are preferred on account of the fact that all small holes are closed. In cases where pipes must go under floors or in partitions the thread should be tinned and "sweated" into the fittings with solder, when absolutely tight work can be obtained.



SECTION

FIG·31



PLAN

From the Philadelphia Company's general directions to consumers we take the following:

To Start a Fire.

Before turning on the gas, place a *flame* on the fire-brick, or close to the burners; then turn the gas on slowly, taking care that the flame is not extinguished. If the gas is turned on suddenly with full force it may blow out the flame. If this occurs, or if the flame is extinguished from any cause, shut off the gas and wait a moment for the gas that has escaped to blow away before approaching another flame to the fire-place.

A taper is the best for lighting gas-fires, because it leaves no ashes behind and rarely blows out.

When the gas is turned off, as at night, leave the doors of the stove or furnace or the dampers open, so that any gas that may escape from an imperfect fitting will be blown up the chimney.

Where there is imperfect combustion, the gas either goes up the flue unburned or out into the room, where it fastens upon furniture, wall-paper, and curtains, and forms a greasy deposit, which is not particularly injurious, but it

should not be, for it can be easily and surely prevented. Burners must be examined by a good plumber, and a proper mixture of gas and air insured.

It is always best to evaporate water at the fire, allowing the vapor to mingle with the air of the room; it does no good if the vapor escapes up the chimney, as many permit it to do.

In case a coal-fire is wanted in the stove or fire-place, the supply of gas failing (which might occur from necessary repairs or alterations to the main pipes), remove the loose fire-brick or crucible in the fire-place. If the burners can be readily removed, displace them, but if they cannot, put the coal in over them; this fire can be burned for several hours without damage to the fixtures. The perforations in the burners can be cleaned out by allowing the gas to blow through them for a moment or two. Keep the gas turned off outside the regulator until the coal-fires are all extinguished and the burners are cool. New burners must be put in promptly, if the old ones are burned from long exposure to coal-fire.

When the escape of gas is discovered in a cellar or elsewhere, *open the windows* to let it escape; avoid lighting it by any flame; as the gas is lighter than air it will rise to the top of the room. For this reason *open the windows from the top.*

The following instructions are issued by the Fire Marshal of Pittsburg:

Notice to Gas-Fitters.—When natural-gas is to be introduced into dwellings, stores, offices, etc., the following rules must be observed by the parties doing the fitting-work:

All pipes must be tested by the gas company's inspector, with mercury column to ten pounds pressure, from end of line where connection is made, to end of pipes under grates, stoves, etc.

The fitter should have his pump on and see that the pipes are perfectly tight before sending for the inspector.

The ends of pipes under grates, stoves, etc., should first be capped, so as to allow the stop-cocks to be tested; then remove the caps and see if the cocks allow the gas to leak.

In case the mercury drops, a test for leak, by putting ether in the pump, or with soap-water, will be made.

In no case shall a fire-test be used in dwellings, offices, stores, etc. No cement of any kind shall be used for repairing faulty fittings or work, nor is the use of *blind gaskets* permissible.

When any attempt to hide leaks is made, the name of the fitter will be kept on record at this office, and future work done by him will not be approved without rigid examination.

In running pipes to buildings, no set rules can be given, except that pipes must in all cases, when possible, be so placed that they can be easily inspected, and that in case of accident any leaking gas may escape easily.

Cement wall carefully where service-pipe enters the building, and use a large pipe for the main that runs through the cellar. Provide valves to shut off gas from all risers. In running pipe through flues, great care is necessary, and lead pipe for the bends should not be used.

Do not run pipes between floors or walls when any other method can be employed. Do not place cocks between floors and ceilings. Do not use any valves which require packing at the stem, in places where leaking gas may be dangerous. If pipes run outside of walls, provide a drip.

Allow plenty of air under the grates, so that the hearthstone may not get too hot. Set the back tile in grate so that the unburnt gases will be directed up the chimney, and not allowed to enter the room.

Admitting more air under the grate, so that it will percolate through or between the hot bats in grate, results in a cheerful, bright fire from bottom of grate to the top of fittings, and also in front.

In fitting up a building, all gas-fitters will be required to furnish the gas company who are to supply the fuel with a statement giving the number of fires fitted up, and also any additional fires that may be connected afterwards in the same building, so that a complete record may be had at this office. Blank forms for this purpose will be furnished by the different companies supplying natural-gas.

It should be borne in mind that a leak of natural-gas is not so perceptible as of artificial gas, on account of the very slight odor arising from it, and more care should be taken in piping a building for its use.

Fitters should also remember that accidents and explosions are likely to occur through defects in fittings and pipes, and as the introduction of natural-gas is a benefit to the fitters, the community at large, and to the insurance companies, the fitters should do all in their power to make the use of natural-gas as safe as possible, and they can materially aid in this by endeavoring to put in pipes and fittings in a perfect manner.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

LIVERPOOL SPECIFICATION FOR SYPHON-CISTERNS FOR FLUSHING WATER-CLOSETS.

LIVERPOOL CORPORATION WATER-WORKS—TESTING AND STAMPING DEPARTMENT.

THE Liverpool Water Department allows a water-closet-cistern that discharges by means of a syphon to be used if made in accordance with the following specification:

1. No cistern shall give more than two gallons at one flush, and the flush shall not be greater if the pull is quickly released than if held until the flow ceases.

2. No connection will be allowed between the cistern and the flushing-pipe, except through the syphon.

3. All working parts must be of gun-metal, or faced with gun-metal, or of other approved material not liable to corrode.

If any part of the syphon is made of iron, it must be coated in an approved manner, and of such dimensions as to permit of corrosion taking place without lessening the efficiency of the cistern.

4. The top of the syphon-pipe or bend must be above the top of the cistern, or the syphon be otherwise so constructed that a leakage from the ball-cock, when the cistern is not in action, will flow over the sides of the cistern before flowing down the flushing-pipe.

5. The cistern must be so made that a constant flow of water cannot be obtained by any manipulation of the pull or lever.

6. The syphon must be capable of being brought into action by a gentle pull of the lever when the water-level is at least one inch below the bottom of the overflow. Cisterns which require a quick pull to start the syphon will not be stamped.

7. The appliance for starting the syphon must be of a durable and simple character, easily repaired or renewed, and not liable to be disarranged or injured, or to rapid wear.

8. It should also work without much noise or jar.

9. The corners of iron cisterns to be rounded off as a protection against frost.

10. The details of strength and material are to be subject to approval, and are to be generally equal to the standard samples of fittings exhibited in the Testing Office.

THE Master, Wardens, and Court of the Plumbers' Company, of London, had a banquet a few weeks ago, and, in speaking to the toasts, the Master, Alderman Knill, made some remarks of interest.

He referred to the work the company was engaged in connected with the technical improvement of the trade throughout the country. Under the direction of the company a full investigation had taken place into the actual internal condition of the trade, and the result of that inquiry established these three things:—That the trade already contained among its masters and operatives a large number of unqualified men, and was subject to a continual influx of unqualified men; that the deterioration of the trade was due in part to the falling off in the apprenticeship system, and in part to the rapid extension of buildings, and the consequent competition of builders obscuring the real lines of distinction between the crafts, and allowing laborers and others than plumbers to carry out plumbers' work; that the execution of defective and dishonest plumbers' work was rendered easy by the laxity or entire absence of official supervision and control. At the present time no kind of recognized authority existed touching either the qualification of plumbers or the efficiency of the work done by them. This state of things was now met in some degree by the scheme of registration, which was already so far extended as to embrace several hundred plumbers and journeymen in various parts of the kingdom. Plumbers who could satisfy the Registering Committee that they had sufficient experience in the trade were registered at once; those who could not so satisfy the committee were required to undergo an examination. He promised that the company would continue to do its part; but the movement must have the extended support of the sanitary authorities, the architects, and the public at large to render it really successful.

EXPERIMENTS ON TRAP-SYPHONAGE.

MR. GLENN BROWN requests us to say that those readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD who have seen Mr. J. Pickering Putnam's strictures on Mr. Brown's experiments, as published in our issue of December 11, can obtain the latter's reply by addressing Mr. Brown, at No. 607 Louisiana Avenue, Washington, D. C.

DEATH FROM SEWER-AIR.

AN inquest was held at Liverpool, on the 8th inst., on the body of a youth who had been employed as apprentice to a plumber. The deceased had in the previous week been engaged in repairing some pipes connected with other pipes which led into a sewer. A good deal of gas came through the pipes, and the deceased complained of pain and sickness. He went home, feeling ill, and died in forty hours. The medical evidence was to the effect that death was due to the inhalation of sewer-air, and the jury returned a verdict in accordance with this testimony.—*The Lancet.*

BOSTON MASTER PLUMBERS' ASSOCIATION has elected the following officers: President, John H. Stevens; First Vice-President, Henry Hussey; Second Vice-President, Isaac Riley; Third Vice-President, John W. Cordon; Recording Secretary, William N. McKenna; Financial Secretary, E. Perkins; Corresponding Secretary, F. A. Titus; Treasurer, John Crawford.

THE St. Louis, Mo., Master Plumbers' Association has elected the following officers: President, Jeremiah Sheehan; First Vice-President, James A. Lynch; Second Vice-President, P. H. Callahan; Treasurer, Thomas Cantwell; Recording Secretary, Oscar J. Gerhard; Financial Secretary, Philip C. Ring; Corresponding Secretary, Arthur Boyce; Sergeant-at-Arms, Martin Taaffe.

THE Master Plumbers' Sewer-Pipe Association gave a banquet to the Milwaukee Master Plumbers, Thursday, January 6, 1887, at Hintze & McLaughlin's restaurant, and an enjoyable time was had by all who were present.

THE explosions of water-backs begin to be reported again. In Chicago on January 3, the water-back was frozen, the fire was started, the back exploded, and the head of the family was injured for life.

THE Board of Health of Syracuse, N. Y., has condemned the high school on account of its defective plumbing. It was built in 1869 at a cost of $100,000.

AN explosion of gas was caused in an Eighth Avenue building in this city a few days ago by ignition of leaking gas at the lamp of a plumber who had gone into the cellar to thaw out a gas-meter.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith, and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

THE DANGER OF ODORLESS FUEL-GAS.

(Special Correspondence.)

TROY, N. Y., January 8, 1887.

THE danger to human life from odorless fuel-gas has just had a practical demonstration in Troy, N. Y., where this kind of fuel has been in use for nearly a year. The Troy Fuel-Gas Company bought the plant of the Steam-Heating Company and converted it into a fuel-gas works, using the old steam-mains for their gas. The company has achieved comparative success, furnishing as many customers as they could from their 10,000-feet holder. The laundries are the largest consumers, but a good many dwellings, hotels, restaurants, and other establishments are using the gas for heating and cooking.

A month or so ago six operatives in Gardner's laundry were prostrated from some unknown cause. They were taken with chills and headaches, and, before they thought it advisable to quit work or call in medical aid, they were rendered helpless. A hasty examination revealed the fact that a stop-cock had been left partly open and that fuel-gas was escaping into the room. Dr. Kinlack being called in administered restoratives, provided fresh air for the patients, and they soon recovered. Some time after this two or three employees in P. J. Fitzgerald's restaurant were similarly affected from a similar cause. In both these cases the deadly gas escaped through the carelessness of those who used it.

Last week, Wednesday, January 5, however, the danger from this gas appeared from a different and an alarming source. About noon twelve persons engaged in business and employed in four different stores in the same block were prostrated as effectually as were the laundry and restaurant people above referred to, and none of the stores use the fuel-gas. The stores are all on the same side of the street, and are Nos. 373, 375, 377, and 361 River Street,

situated one block away from the gas-works. By reference to the above numbers it will be seen that the effect was felt in alternate stores with the exception of the last one named, which is several doors from its nearest afflicted neighbor. The Troy Paper Company occupy No. 373. It is a 3-story and basement store, with front and back light and ventilation. About noon on the day mentioned, without any premonitory symptom, George W. Van Alstyne, one of the proprietors, experienced a chill and a disarrangement of his physical organism. His eyes smarted, he became slightly dizzy and somewhat benumbed. Believing a little fresh air would be good for him, he went out doors, and, having an errand further up the street, he got into a passing horse-car. He had hardly entered it when he tumbled over helpless. The passengers made room for him, and, after a short time, he revived sufficiently to leave the car himself and make his way along the street. Soon after he left the store another one of the proprietors, William L. Van Alstyne, experienced the sensations which George afterward described. While talking to a customer, John Manning, he put his hand to his head and said, "You will have to excuse me a moment, I feel so dizzy." Thereupon he fell to the floor helpless. Mr. Manning carried him to the rear of the store. Meantime an employee named Hawes had felt the prevailing symptoms and had gone to a neighboring drug-store to get a prescription for himself. On returning and finding William L. Van Alstyne in the condition he was in he sent for Dr. Kinlack, whose office was near by. When the doctor arrived his first question was whether fuel-gas was used in the store. He was told it was not used, but, having had former experience of its effects, he ordered the doors to be thrown open and the windows to be raised. While he was attending to Mr. Van Alstyne others found the colored porter in a helpless condition at the head of the cellar stairs. Stimulants and fresh air brought the patients round so they could help themselves and start for their homes. Then it occurred to Hawes and another attache of the store, who, having been out in the air a good deal, were not so badly affected, that the store boy was missing. He had been sent upstairs when the doctor arrived to open windows in the second story. When called he did not answer. One of the men hurried upstairs, and there he found the boy lying on the floor near the window which he had raised a few inches. He was so stiff that he could have been stood up like a board. He was carried below and was brought round with a good deal of difficulty. As soon as consciousness returned he vomited furiously and complained of distressing headache. All these patients were seized first with chills, their sight became dim, and aches went through their bones as if fever was about to set in. In the severest cases the muscles relaxed so that the victims fell helpless, and, in the case of the boy, the muscles next became rigid. If assistance had not been prompt they would probably have died.

In the store No. 363 the victims were William T. Williamson and John S. Kilby, employed by Burden & Co.; at No. 375 Thomas Davenport and three other employees, and at No. 377, Starkweather & Allen's store, Joseph Crosby, Frank L. Allen, and Edward Jessup were stricken down, though less severely than the Van Alstynes were. Kilby tumbled out of his chair, Davenport fell but was caught by a bystander, and Crosby dropped to the floor as suddenly as if he had been knocked on the head. All the victims except George W. Van Alstyne suffered from the effects for nearly twenty-four hours.

The explanation of how the gas got into the stores is that it entered through the sewer-pipes from a break in the gas-main, which is the old steam-heating main. In two of the stores, however, the old steam-heating pipes are still in but are not used. In the rear of the stores there is a laundry where the gas is used, and it is noted that for some time the laundry people had complained that they could not get enough gas to heat their apparatus. Some of those who were afflicted threaten to bring suit against the gas company. Since the occurrence the leak in the main has been repaired. In no case did one of the victims have the slightest warning. There was no odor of gas or any thing else either before or after the prostrations.

THE HOT WATER WILL NOT FLOW.

STERLING, ILL., December 8, 1886.

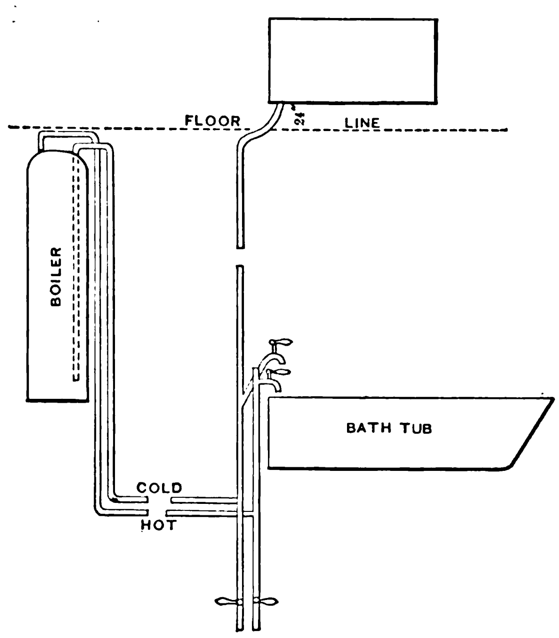
SIR: I have inclosed sketch of hot-water boiler, etc., in which I can't get the hot water to work—or, rather, to run—at bath-tub when it gets very hot. When a little warm or cold it works nice. Would like to know of best remedy for this trouble. I have my ideas about it, but I thought it would not hurt to get others.

From a constant reader of your paper and a plumber.

Yours respectfully, J. S. JOHNSTONE.

P. S.—The tank can't be raised any higher, and the boiler is a short one, so that no more fall can be had.

J. S. J.



[We see no reason why you cannot get the hot-water faucet to run water, unless it is that you make steam in the head of your boiler. Then it is just possible that the syphonic action is broken in the hot-water pipe and that the pressure prevents the cold water from flowing into the boiler to establish it again. If some of the water in the top of the boiler is forced into the cold pipe through the small side hole, the remainder cannot reach the top (hot) outlet, and, consequently, cannot go out that way until things cool and allow the cold water to come back and fill the boiler. We think a short tube carried downward from the hot-water coupling to an inch below the hole in the cold water *inside* tube would remedy the trouble, as then the pressure or expansive force of the steam in the boiler would force the hot water over, and at the same moment by the reduction of the steam-pressure the cold water would assert itself and flow in producing a proper flow of very hot water.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
January 8........	24.37	19.92	20.74	30.34	30.09	22.56	31.04

E. G. LOVE, Ph.D., *Gas Examiner.*

SENATOR GRISWOLD'S bill reducing the price of gas in Brooklyn to $1.50 per 1,000 cubic feet is being bitterly opposed by the Brooklyn companies.

JUDGE MORAN, of the Illinois Appellate Court, has rendered a decision in the case of the People's Gas-Light and Coke Company, against the Chicago Gas-Light and Coke Company, perpetually enjoining the Chicago company from laying gas-pipes and mains in the west division of that city.

THE Scientific Publishing Company of London has just issued its yearly publications of gas and water statistics for 1886. That on "Gas-Works Statistics" is edited by Mr. Charles W. Hastings, and has reached its eighth issue. "The Gas and Water Company's Directory" is also edited by Mr. Hastings, and now appears as the tenth issue. These publications are already well known to our engineers, and their value acknowledged. The returns furnished by English gas and water companies are naturally more complete, and therefore more satisfactory, than those from the Continent and the United States. The Gas-Works Statistics show returns, more or less complete, from about seventy companies in the United States. This number should be larger, and as companies overcome their reluctance to furnishing information of their working, it doubtless will be. In England the Parliamentary supervision of these companies insures the publication of returns, which with us are purely voluntary.

ELECTRIC-LIGHTING seems likely to meet with a most formidable rival in the discovery of a gas glow-lamp, recently described by Richard Pintsch before the "Society for Railway Knowledge," at Berlin.

The light is produced by heating a cylinder of specially prepared material to white heat by a gas-flame burned inside of it. Outside of the glowing substance an argand chimney is placed for its protection, the lighting cylinder being hung from the glass one by platinum wire. The heating substance is made of cotton, impregnated with a preparation of the mineral cerite. The durability—though exposed to air—is apparently equal to that of the electric glow-light carbons in a vacuum, for Herr Pintsch reports a light that has been used 5,000 hours still in working order, though decreased in power. He estimates its ordinary life without perceptible loss of power at from 1,000 to 1,200 hours.

Its advantages are:

First—Cheapness. A Bunsen burner is used, consuming half the quantity of gas for the same light.

Second—Less heat, by reason of the smaller gas consumption.

Third—A white light, in which almost all colors appear exactly as in sun-light.

Fourth—Great steadiness of light, as the glow does not vary immediately with the variations of the gas-flame.

Fifth—Milder quality, owing to the enormously increased lighting surface.

Sixth—The absolute consumption of the gas, leaving no destructive and soiling soot on furniture or on the glass chimney.

Seventh—Easy application, inasmuch as all the apparatus of common gas-lighting except the burner is perfectly applicable to the new light.

NEW GRAVING-DOCK AT ESQUIMALT, B. C.

THE new graving-dock at Esquimalt, the English naval station, near Victoria in British Columbia, which has been under construction for some years past, is now substantially completed, and will be opened for use the coming spring.

Its general dimensions are as follows:

Length on coping, inside, from gate to head of deck	450 ft.
Length on floor	430 ft.
Width on coping, inside	90 ft.
Width on floor	41 ft.
Width on coping, inside, of outer invert entrance	69 ft.
Width on coping, inside, of inner invert entrance	65 ft.
Depth from coping to inverts	33 ft. 6 in.
Depth from coping to floor	36 ft. 6 in.
Depth from coping to floor of caisson-berth	36 ft. 10½ in.
Depth from high-water level, spring tides, to inverts	26 ft. 6 in.
Inclination of floor	1 ft. in 400 ft.

The dock is built of hard sandstone, backed with Portland cement concrete. The inner abutment of caisson-berth is faced with granite. The caisson-gate is of wrought iron, known as Kinipple's Patent Traveling Caisson, arranged to slide into a recess between the inner and outer inverts on one side of the dock, and is provided with a folding or lowering bridge. The masonry of the dock is completed, and the caisson-gate is in course of erection on the dock-floor. After completion of the latter, there will only remain the removal of the coffer-dam before the structure can receive a ship for docking.

The main pumping-machinery consists of two lift-pumps, 4 feet in diameter and 5-foot stroke, and was manufactured by Watt & Co., of Birmingham, England. An independent auxiliary engine operates a small drainage-pump, and hauls the caisson back and forth. The probable ultimate cost of the whole work is estimated at about $800,000.

A MANUAL OF HEATING AND VENTILATION, IN THEIR PRACTICAL APPLICATION. By F. Schumann, C. E. 2d Ed. 98 pp., 12mo. New York: Van Nostrand. 1886.

This book contains a series of the formulæ most used in calculations as to amount of air-supply, transmission, and loss of heat, friction, flow of water, and of steam in pipes, combustion of fuel and hygrometry, the action of ventilating-fans, etc., and is a very convenient book of reference for the engineer and architect, who have acquired the theoretical knowledge necessary for its comprehension.

UTILIZATION OF WOOL GREASE.

AMONG the various sources of the pollution of streams which are the most important and, heretofore, the most difficult to deal with satisfactorily, may be reckoned the waste waters of establishments in which the washing and cleansing of wool is carried on. The difficulty has been to find some cheap and effectual method of separating the peculiar animal fatty substance which these waters contain, and thus to obtain a product which should have sufficient commercial value to repay the expense of the process. It has recently been announced that this fatty matter when thoroughly purified forms a valuable medium for external applications to the skin, and a demand for it, under the name of "lanolin," has thus arisen which will make it worth while to save it. Methods of doing this by mere condensation and filtration have not proved satisfactory, but the journal *Le Genie Civil*, of December 18, 1886, contains a communication from M. Robart to the National Agricultural Society of France, in which he shows that this peculiar grease can be easily saponified by changing its elementary constitution. When heated to its point of fusion this grease will absorb more than one hundred-fold its volume of sulphureted hydrogen (H. S.), and in this condition can be saponified in a cold state. This saponification takes but six hours, whereas soaps with a base of soda takes from six to eight days to saponify. A sample of soap was shown manufactured by Messrs. Michaud Bros., of Aubervillier, near Paris, which was very fine.

Another advantage is that this saponification can be obtained with alkaline *carbonates*, which is much more economical than the caustic alkalies heretofore used.

This scientific fact applies as well to fatty matters previously sulphureted. In their presence the alkaline carbonates are decomposed, the carbonic acid escaping in great abundance, and a perfect soap is obtained. This sulphureted soap of wool grease is a new and cheap product which may be applied to many uses.

A WATER-WORKS FOR SALE.—The Camden, N. J., *Courier*, of the 6th inst., contains the following: "The city water-works came near being sold the other day by James A. Freeman & Co., the Philadelphia auctioneer firm. The property was advertised, and would have been knocked down to the highest bidder but for City Solicitor Morgan, who had the sale stopped. The trouble occurred through a mistake concerning the city's title to the land on which the pumping station stands at Pavonia, this site being included in a list of properties to be sold by the Pavonia Land and Improvement Company. Solicitor Morgan's attention was called to the matter and he looked up the city's title to the property, which had been obtained first by the purchase of a portion of it from private parties and afterward by securing the State s riparian rights. On notifying Freeman & Co. that they had no right to sell the property, it was stricken from the list."

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE annual meeting of the society will be held January 19 and 20, 1887, at the society's house, in this city, as previously announced. On January 19 the meeting will open at ten o'clock, and will continue through the day and probably during the evening. Lunch will be served at the society house. During the meeting the annual reports will be presented, officers for the ensuing year elected, the awards of the Norman Medal and of the Rowland Prize for the past year will be announced, reports from various committees presented and discussed, technical subjects will be discussed, and in connection with the subject of tests of structural materials Mr. Charles Macdonald, M. Am. Soc. C. E., will describe a 600-ton testing-machine recently erected. On January 20 a visit will be made to the new railway draw-bridge over the Harlem River at Second Avenue; a trip will be taken over the line of the Suburban Rapid Transit Railway; thence by steamboat to Greenpoint, where a visit will be made to the Continental Iron-Works. Lunch will be served in the offices of these works; thence by steamer to the Statue of Liberty Enlightening the World; thence return to New York. In the evening a reception for gentlemen will be held at the house of the society, and a supper will be served in the library.

J. JAMES R. CROES,
WILLIAM H. WILEY,
WARREN E. HILL,
JOHN BOGART, } *Committee.*

INSTITUTE OF MINING ENGINEERS.

THE forty-seventh annual meeting of the institute will be held at Scranton, Pa., beginning February 15. Communications concerning arrangements, rooms, etc., may be addressed to Mr. E. S. Moffat, Chairman of the Local Committee. The hotel headquarters will be at the Wyoming Hotel; rate $3 per day. No special railway facilities will be furnished for this meeting. The programme for the meeting will include visits to steel-works, machine-shops, and collieries, and there will be a subscription dinner on Friday evening, February 18, at the Wyoming Hotel.

Members desiring to present papers at this meeting are requested to notify Mr. R. W. Raymond, P. O. Box 223, New York City, Secretary of the Institute, as soon as possible, and to send at an early day either the papers in full or such an abstract or description of them as will enable the council to judge of their nature and length, the number and size of illustrative drawings, etc.

THE Western Society of Engineers, at a meeting in Chicago, January 4, elected the following officers: President, Samuel G. Artingstall, City Engineer; First Vice-President, Professor Lyman E. Cooley, Assistant City Engineer; Second Vice-President, Professor I. O. Baker, Professor of Engineering in the University of Illinois at Champaign; Secretary, L. P. Morehouse, Tax Claim Agent of the Illinois Central Railroad; Treasurer, A. B. Powell, Superintendent of Public Works, Hyde Park; Librarian, G. A. Liliencranz, United States Civil Engineer; Trustees, H. A. Rust, of the Chicago and South-western Railway.

THE Worcester County, Mass., Society of Engineers held its annual meeting January 7, and elected the following officers: President, A. C. Buttrick; Vice-President, Charles A. Allen; Secretary, A. J. Marble; Treasurer, Edward K. Hill. On the Executive Committee in addition to the above, Messrs. Phineas Ball, William C. Boyce, of this city, and George A. Craige, of Spencer, were elected. Mr. Samuel Jenning and W. H. Harvey were elected as new members. Prof. George M. White, C. E., gave a description of the Minnehaha Bridge over the Mississippi River below the falls of St. Anthony.

THE Texas Society of Engineers met in San Antonio, January 4, and adopted a resolution endorsing the efforts of Texas architects to induce legislation for the regulation of their profession. The election of officers was postponed till the next meeting.

THE third annual meeting of the Connecticut Civil Engineers' Society was held in Hartford, January 11. The following officers were chosen: President, C. E. Chander, of Norwich; Vice-Presidents, H. J. Kellogg, of Waterbury, and C. H. Bunce, of Hartford; Secretary and Treasurer, D. S. Brinsmade, of Birmingham.

PERSONAL.

ALFRED C. CLAS has severed his connection with J. Douglas & Co., and will open an architectural office at 421 Milwaukee Street, Milwaukee, Wis.

HERMAN P. SCHNETZKY has severed his connection with H. C. Koch & Co., architects, of Milwaukee, and opened an office in the same building, 107 Wisconsin Street.

COLONEL CHARLES E. BLUNT, U. S. Engineer Corps, has been placed on the retired list.

LIEUT.-COL. ALFRED MORDECAI, of the Ordnance Department, has been assigned to command the New York Arsenal.

PRESIDENT RICHARDS, Institute of Mining Engineers, has recovered from his recent severe illness, and will be present at the annual meeting of the Institute at Scranton next month.

CHIEF ENGINEER B. S. CHURCH, of the New Croton Aqueduct, will prepare a report of the work from the beginning to the present time.

MR. GEORGE L. FOWLER, editor of the *American Journal of Railway Appliances*, has been appointed First Assistant Commissioner to the International Railway Exposition to be held in Paris the coming summer. Mr. Fowler's address is 113 Liberty Street, New York.

WILLIAM GURLEY, President of Rensselaer Polytechnic Institute, died at Troy last Monday. Mr. Gurley graduated from the institute in 1839 in the same class with Professor George H. Cook, State Geologist of New Jersey, and Strickland Kneass, long connected with the Pennsylvania Railroad. Mr. Gurley's death will be a cause of great regret to many engineers and others who know and esteem his services to education in Troy. It was largely by his exertions that the Willard Seminary was preserved as a school for ladies in that city. He was especially known in connection with the mathematical instruments of which he was the manufacturer.

JAMES STANDISH, a Boston, Mass., contractor, died there January 5, aged 75 years.

JOHN ROACH, the leading American ship-builder, died, January 10, of cancer, from which he had been for some time suffering.

THE COMPETITION FOR PLANS OF THE CARNEGIE LIBRARY.

THE award in the competition for plans of the Carnegie Library in Allegheny City, Pa., has been made to Messrs. Smithmeyer & Pelz, of Washington, D. C.

SURGEON-GENERAL HAMILTON, of the Marine Hospital Service, has just finished an inspection of the ports of the Atlantic and Gulf coasts to ascertain what safeguards are needed to prevent the introduction of cholera or yellow fever.

THE Citizens' Committee of Washington, D. C., has sent a memorial to the Senate District Committee, setting forth that the price of gas in the District is excessive, and asking for legislation to secure a reduction.

THE Chief Inspector of Plumbing and House-Drainage of Philadelphia has reported to the Board of Health that during the past seven months 5,362 plans for the drainage of buildings have been approved, and 134 disapproved. There has been made a total of 18,209 visits of inspection by the inspectors, and 3,259 plans finally approved and work finished. He also reports that the total number of persons and firms regularly registered as doing business as master plumbers is 518.

A STEAM-YACHT is to be fitted up in England with a Brush dynamo and electric-light equipment, to be used in the process of pearl-fishing on the South Australian coasts.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 8. PUBLISHED EVERY SATURDAY.

NEW YORK, JANUARY 22, 1887.

LONDON, FEBRUARY 5, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

HOW TO PRESERVE OUR PAVEMENTS.

IN his address to the new Board of Aldermen of this city, President Beekman made the following reference to the continual destruction of our pavements:

"The condition of the pavements of the streets and avenues in various portions of the city has long been a well-founded subject of complaint.

"Under authority from the Legislature various private corporations, in furtherance of their business objects, are constantly removing the pavements and excavating in the public streets.

"The result of this is that the pavement, insufficiently restored, becomes depressed, holes, ruts, and channels are formed, and an irregular surface is occasioned over which it is painful to travel, and which collects instead of shedding water and waste material.

"While, no doubt, the convenience and comfort of the public are greatly increased by the advantages which these companies afford in their particular lines of business, it is quite certain that the privileges they enjoy are of exceptional value, and it can be no hardship to require of them all the speed, care, and skill that can be exercised in the rapid and satisfactory completion of their work.

"While this board possesses no power to prevent the use of the streets for such purposes, it may at least pass reasonable rules and regulations, as it has in some measure in the past, defining the manner in which such excavations may be made and the street surfaces properly and permanently restored. Having determined upon the most approved methods of doing such work an ordinance should be passed strictly enforcing compliance with such methods and requiring the greatest expedition in performing the work—too often protracted beyond a reasonable time for its proper execution."

What he said may be news to an alderman, but it is no news to any engineer or any one having the slightest familiarity with municipal engineering. It is our deliberate opinion that no matter what ordinances may be passed, what regulations adopted, or however good the inspection may be, the pavements of this or any other city will never be in decent condition until all removals and restorations of pavements are done *solely by the city's own employees and agents*, for which work any corporation or individual who desires the streets to be disturbed should be compelled to pay the cost; and that cost should be sufficient to secure thoroughly sound work and also the cost of a reasonable maintenance. We are under the impression that this is the practice in Liverpool, if not in other foreign cities, and by this means, and this means only, will people avoid the opening of a street except in most imperative cases. Indeed, there are many occasions on which a street is now torn up, when, if there was a sufficient tax placed upon such tearing up, the parties interested would find some way of tunneling or accomplishing the purpose without a disturbance of the surface.

DEATHS FROM ODORLESS FUEL-GAS.

LAST week THE SANITARY ENGINEER AND CONSTRUCTION RECORD printed from a reliable correspondent in Troy an account of the effects of the leakage of odorless fuel gas wherein a number of persons were overcome, though no case resulted fatally. It then took the ground that stringent legislation should at once be enacted to prevent any body from manufacturing or distributing odorless fuel-gas, citing this experience as a reason for such action. Two days after the publication of this account, a press dispatch from Troy stated that three persons were found dead in another building from the effects of this same gas which leaked from a defective plant, and, being odorless, gave no warning.

The *Troy Times*, in alluding to our editorial, says: "In the light of the tragic occurrence of Saturday night, by which three souls were hurried into eternity, THE SANITARY ENGINEER AND CONSTRUCTION RECORD'S words read like prophetic warning." The State Board of Health should make it its business to at once have introduced in the Legislature a bill to prohibit the manufacture or distribution of any gas in this State that has *not a perceptible odor*. It is not within the possibilities of any human agency to construct a plant for the distribution of gas that will not some time or other leak, and the only safety the community has when coal-gas does leak is the fact that it has hitherto been at once noticeable by reason of its pungent odor. Now is the time to secure such legislation. Meanwhile a perpetual injunction should be sought from the courts restraining the Troy Fuel-Gas Company from manufacturing any more of this dangerous gas. An account of the fatal catastrophe will be found elsewhere in this issue.

ANCIENT HYGIENE.

THE Boston *Medical Journal* has recently published a lecture on the hygienic laws and sanitary conditions of Ancient Rome, which formed one of a course of lectures delivered before the Lowell Institute by Professor Lanciani, the Government Director of Archæological Researches at Rome.

As might be expected from such a teacher, especially when speaking to such an audience, the address contains much that is interesting to the modern sanitarian. Professor Lanciani suggests that the existence of a thriving and healthy population in the Campagna about Rome, where a few centuries later (at the beginning of the historic period) the locality is described as pestilential, may have depended on the purifying influence exerted by volcanic fires and sulphurous emanations. At all events, malaria invaded these regions as soon as they ceased to be volcanic, and a proof of its prevalence is found in the large number of altars and shrines dedicated by the early inhabitants to the Goddess of Fever. One altar has been found which was consecrated to Verminus, who to-day would be reckoned as the God of Bacteria.

By the construction of drains and sewers, the providing a general water-supply, and by regulating burials, etc., Rome was gradually made a healthy city. When these improvements fell into disuse, after the fall of the Empire, the vicinity again became pestiferous, and again they resorted to worship to avert the evils, and built a chapel for the Madonna of the Fever.

The great sewer of Rome, the Cloaca Maxima, is well known as one of the oldest triumphs of sanitary engineering. Recently a still larger sewer has been discovered, of which Professor Lanciani remarks that "the enormous size of its blocks, the beauty and perfection of its masonry, and its wonderful preservation, make it compare most advantageously with the Cloaca Maxima, to which it is altogether superior as regards length and extent of district drained."

The introduction of pure drinking-water to Rome was effected in the fifth century of its foundation. "Fancy what must have been in-

early Roman times the sanitary conditions of a town, the drains of which, not washed by any influx of water, communicated with the streets by large unprotected openings and emptied into a river, the polluted waters of which were drunk by the whole population."

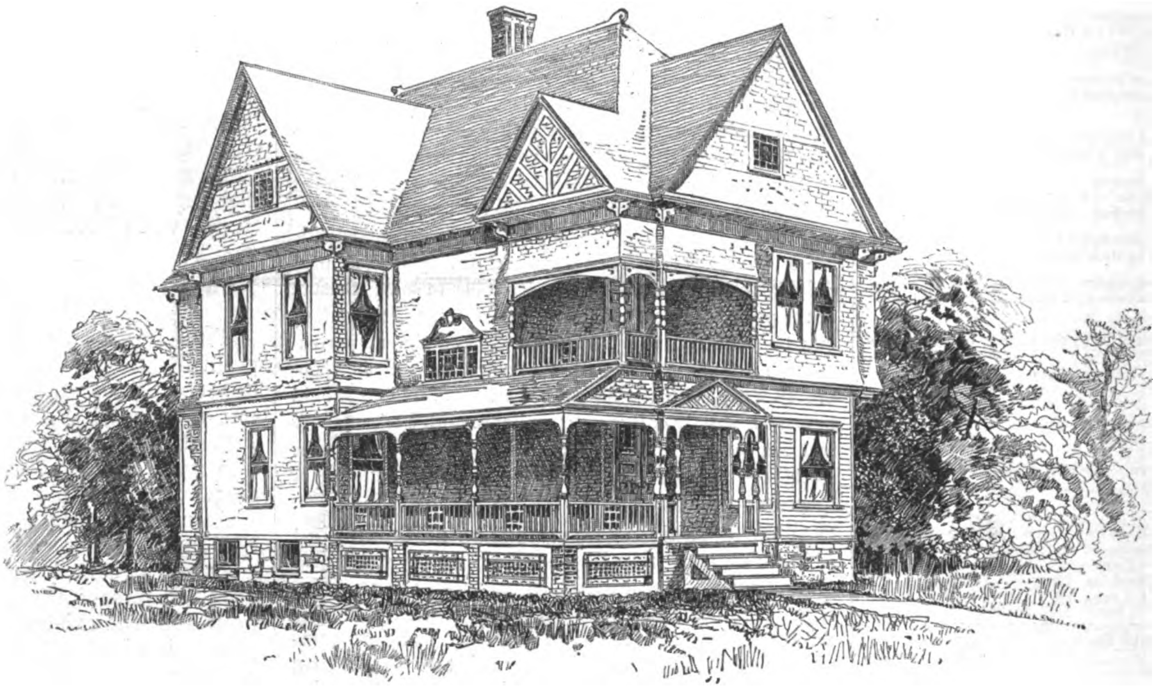
The magnificent water-supply brought into Rome by means of fourteen aqueducts was its salvation. The aggregate length of these aqueducts was 359 miles, of which 354 miles were in tunnels. The longest of these tunnels is that of Monte Affliano, 4,950 metres long, 7 feet high, and 3 feet wide.

The public cemeteries for the reception of the dead of the poorer classes were huge pits, into which the bodies were tumbled promiscuously. In one place a mass of human remains 160 feet long, 100 feet wide, and 30 feet deep was found, which is estimated to have contained 24,000 bodies. In and around the great Esquiline Cemetery the refuse and garbage of a population of nearly a million of people were heaped. Finally, in the reign of Augustus, the whole of this was buried under a mound of pure earth 25 feet high, and a third of a square mile in surface, on the top of which magnificent gardens were laid out.

This produced an immense improvement in the health of the city. It will be seen from all this that there were some wise men and some skilled engineers in those ancient days, and that the sewers have outlasted the temples and the palaces.

A SPARK from a dynamo in the station of the Providence, R. I., Electric-Lighting Company, last Saturday, caused a fire, igniting some sawdust on the floor, which resulted in the death of the engineer and a fireman. Half the electric-lights in the city were temporarily disabled.

IN consequence of the fatal accidents from inhaling escaping gas furnished by the Troy, N. Y., Fuel-Gas Company, the Common Council has suspended the franchise of that company.



RESIDENCE AT CANANDAIGUA, NEW YORK.—O. K. FOOTE, ARCHITECT.

OUR BRITISH CORRESPONDENCE.

Electric-Lighting in Italy—American Import Duties in Thuringia—Recording the Speed of Railway Trains—Snow Plows in London—Explosion on a Petroleum Steamer—Artisans' Dwellings in Glasgow—Colleges and Schools for Technical Education.

LONDON, January 5, 1887.

THE secondary towns in Italy are setting an example of enterprise in municipal electric-lighting. The authorities of Avellino have just signed a contract with Messrs. Taddei, of Turin, for an installation of 250 incandescent Cruto lamps of 32, 24, 16, and 10 candle-power. Arc lamps of 250 candle-power will be used in the Piazza della Liberta. A 150 horse-power compound condensing engine will drive Thury dynamos for the current.

The Thuringian Chamber of Commerce reports that the recent increase in the American import duties on decorative and constructive glass and china goods has considerably reduced the amount of trade done.

A simple apparatus for recording the speed of railway trains is reported from Germany. It consists simply of a series of keys, affixed at regular intervals along the rails, in contact with springs. The weight of a passing train depresses the key, and completes an electric circuit with the nearest station. Here, by a mechanical contrivance, similar to that used for working telegraph tapes, a series of dots are recorded on the tape, the proportionate distances between which represent the rate of traveling.

In connection with the recent rather heavy fall of snow, I hear that two or three London vestries have adopted a crude form of snow-plow with considerable advantage. The system in the city has been to flood the snow from the street hose-pipes and then sweep down the gulleys.

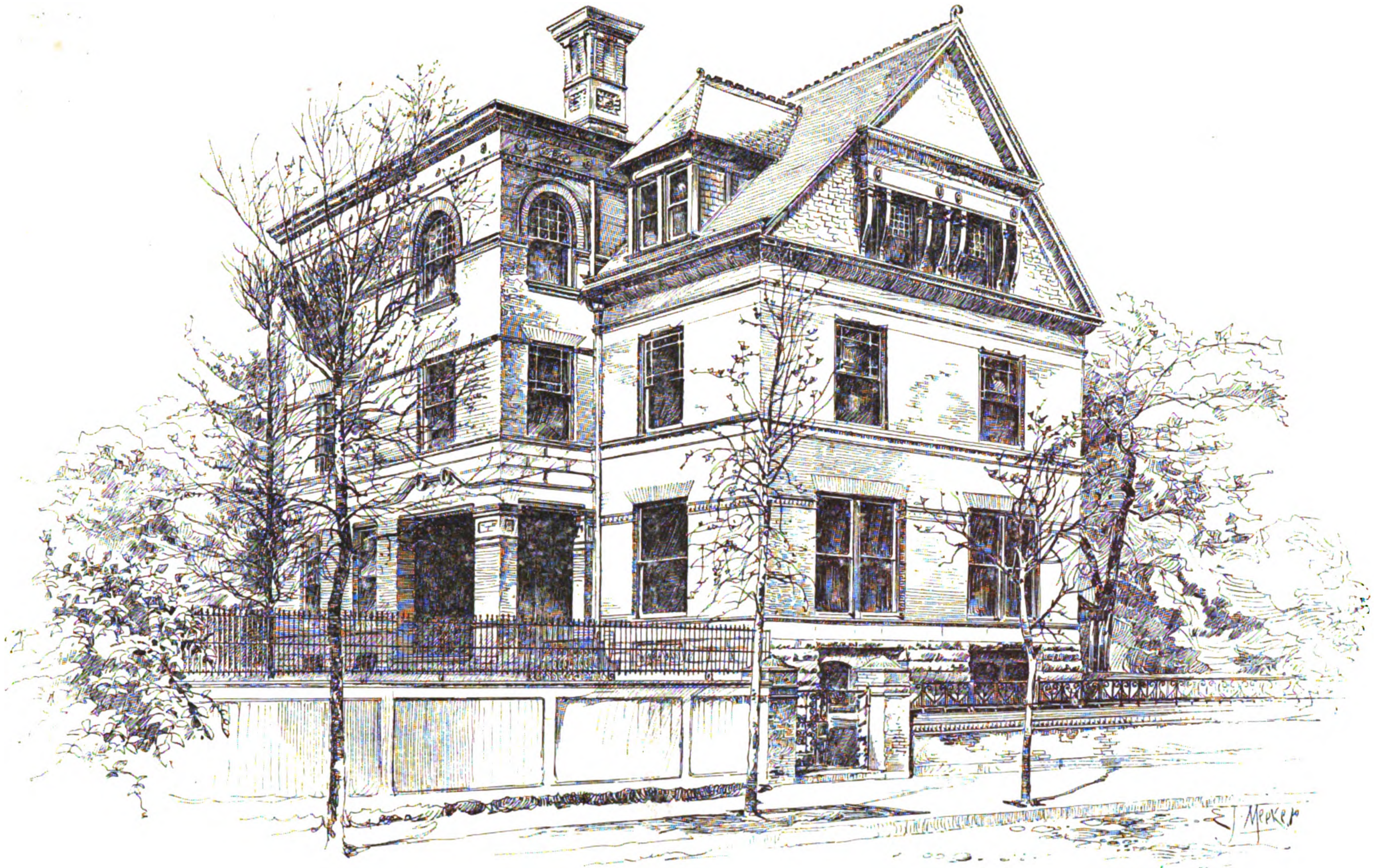
A fatal explosion, attended by a loss of six lives, is reported from the Birkenhead Docks. The "Petriana," a vessel converted from the ordinary cargo-steamer for the purposes of the petroleum-carrying trade, was in dock for repairs, and, although the oil-tanks stood the test of a lighted lamp, an explosion occurred in the course of subsequent working. The vessel is one of the class for carrying oil in bulk. She possesses six tanks, with a total capacity of about 2,000 gallons, and the side of the vessel itself forms the side of the tanks. To the penetrating power of the oil in its crude state, combined with the fact that it gives off vapor at a very low temperature, is to be attributed this unfortunate explosion.

The erection of artisans' dwellings, although as a rule a sound commercial speculation, and, in addititon, beneficial to the public at large, is generally carried out by the philanthropical capitalists or trading companies. The Municipal Improvements Trust of Glasgow, however, in its decision to erect such dwellings on certain waste lands in their possession (the sites of former rookeries), shows sound sense and appreciation of the city's good. They propose to spend some £10,000 ($48,000) on the project, and estimate that the profits will considerably exceed those which would have resulted from letting or selling the land.

The demand for technical schools and colleges is continuously on the increase. There is a movement on foot to establish a college of engineering in Newcastle-on-Tyne, and a meeting of ship-builders and engineers has been convened there to discuss the syllabus of subjects, appliances, and methods of teaching, etc. In this connection it is interesting to note that it is proposed to establish a college for railway employees in Hungary. It is sought to obtain regulations that no man shall obtain employment on any of the State railways before he has passed an examination in applied mechanics, electricity, etc., as well as traffic and general commercial questions in connection with railways.

SAFETY-VALVE.

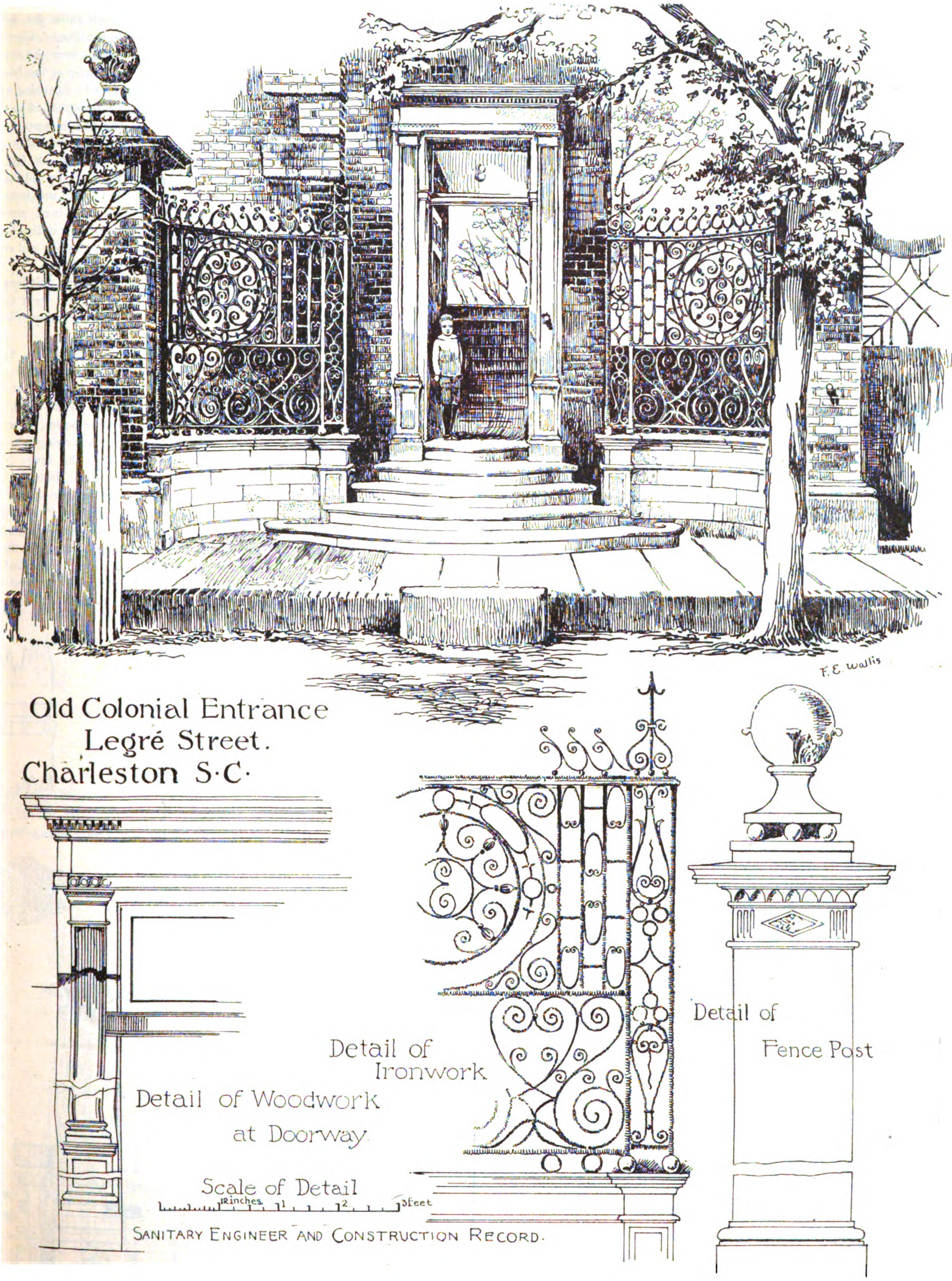
NEW HYGROMETER.—A Frenchman, Mons. A. Nodon, has recently invented a hygrometer which can be put upon the market at a very low rate, but which is claimed to be at once very sensitive and very reliable, so as to be available to all for weather forecasts and for use in such arts as require a nicely-graduated condition of the air as to moisture—hot-houses, for instance. The sensitive medium is a strip of Bristol board, not at all sensitive in itself to moisture, covered on one side by gelatine which changes in length at the least alteration of hygrometric condition. By coiling the Bristol board into a helix, of which one end is firmly held, the other end being connected with a needle on a dial, moves the needle back and forth on a scale as the moisture of the air increases or decreases. The whole thing is inclosed in a box like that of an aneroid barometer and forms a very simple, strong, and, as claimed above, very reliable instrument.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

A PHILADELPHIA RESIDENCE.

T. RONEY WILLIAMSON, ARCHITECT.

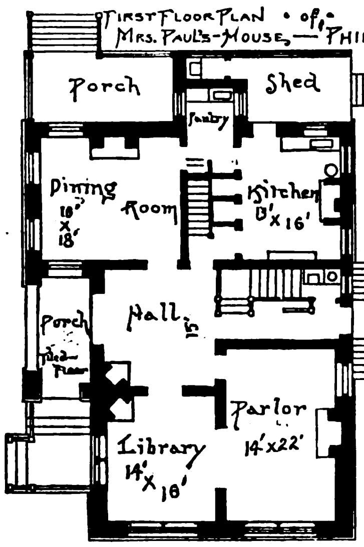

F. E. Wallis
Old Colonial Entrance
Legré Street.
Charleston S·C·
Detail of Ironwork
Detail of Fence Post
Detail of Woodwork at Doorway
Scale of Detail
12 inches 1 2 3 feet
Sanitary Engineer and Construction Record.

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

A RESIDENCE IN PHILADELPHIA.—T. RONEY WILLIAMSON, ARCHITECT.

THIS house, which is situated on Locust Street, Philadelphia, is built of pressed brick, laid in red mortar, with trimmings of Hummelstown brownstone. The cornices

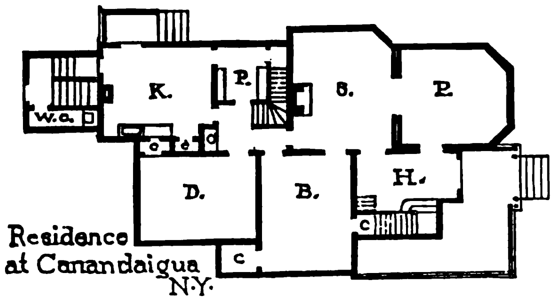


and gable ornaments are of copper. The interior finish is of mahogany, cherry, and oak. The cost was about $30,000. The owner is Mr. James W. Paul, the architect Mr. T. Roney Williamson, both of Philadelphia.

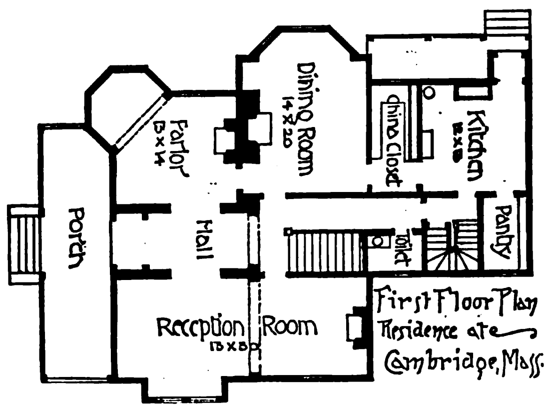
OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE AT CANANDAIGUA, N. Y.—ORLANDO K. FOOTE, ROCHESTER, N. Y., ARCHITECT.

THE subject of our vignette illustration this week is the residence of Mr. E. C. Church, at Canandaigua, N. Y. The frame is of hemlock, the second story and gables are shingled and stained with creosote. The roof is of the



same. The main rooms on the first story are finished in white oak, the other rooms in white pine; all are finished in natural woods, plaster finish, with back molding. The cost was $4,000. Mr. Orlando K. Foote, of Rochester, N. Y., was the architect.



PLAN of house at Cambridge, Mass., C. H. Blackall, architect, Boston, illustrated in last issue. By a mistake the plan of the house illustrated this week was substituted.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. VIII.

(Continued from page 133.)

WE omitted in our last article to state that Messrs. J. B. & J. M. Cornell were contractors for the iron-work.

We wish also to say that Mr. Angus was *contractor* for the stone-setting, and not representative as stated.

Our illustrations this week show the derricks used on the work on the Equitable Building. Figure 35 is one of two used for hoisting materials from the street. The mast is 55 feet high, 2 feet in diameter at the base and 14 inches at the top, and is not arranged for turning on its axis. The boom is horizontal and rigidly attached to the mast. The outward end is 27 feet long and is supported at two points by stirrups attached to 1⅜-inch rods with turnbuckles for adjustment. The inboard end is 18 feet long, and the thrust from the load is taken up by adjustable stays running from the inner end to the top and bottom of the mast. The boom consists of two 6x12-inch pieces, spaced 19½ inches apart, so as to pass the mast without cutting it. They are bolted to it by four 1-inch bolts, and are held apart at the ends by distance-pieces as shown.

There are two rigid struts 70 feet long to resist overturning backwards, and wire-rope guys to resist forward movement. This avoids the necessity of long ropes across the street.

The loads are lifted by blocks and a fall attached to a "traveler" or "trolly." This has solid iron axles 3 inches square at 2-feet 6-inch centres, with cast-iron wheels 10 inches in diameter and with 5-inch tread. These run on flat plates of iron on top of the boom. A heavy link around the forward axle serves for attaching the upper block as shown. The fall passes from the lower block to the 10-inch sheave near the back axle, thence to the sheave near the top of the mast, thence to the sheave in rear end of boom, and from there is led by "snatch-blocks" to the engine. The projections shown on top of the trolly are cheek-pieces to keep the rope in place on the sheave—a very desirable precaution. A rope is attached to one of the sheaves in the front end of the trolly, and runs thence to one of those in the distance-block at the front end of boom,

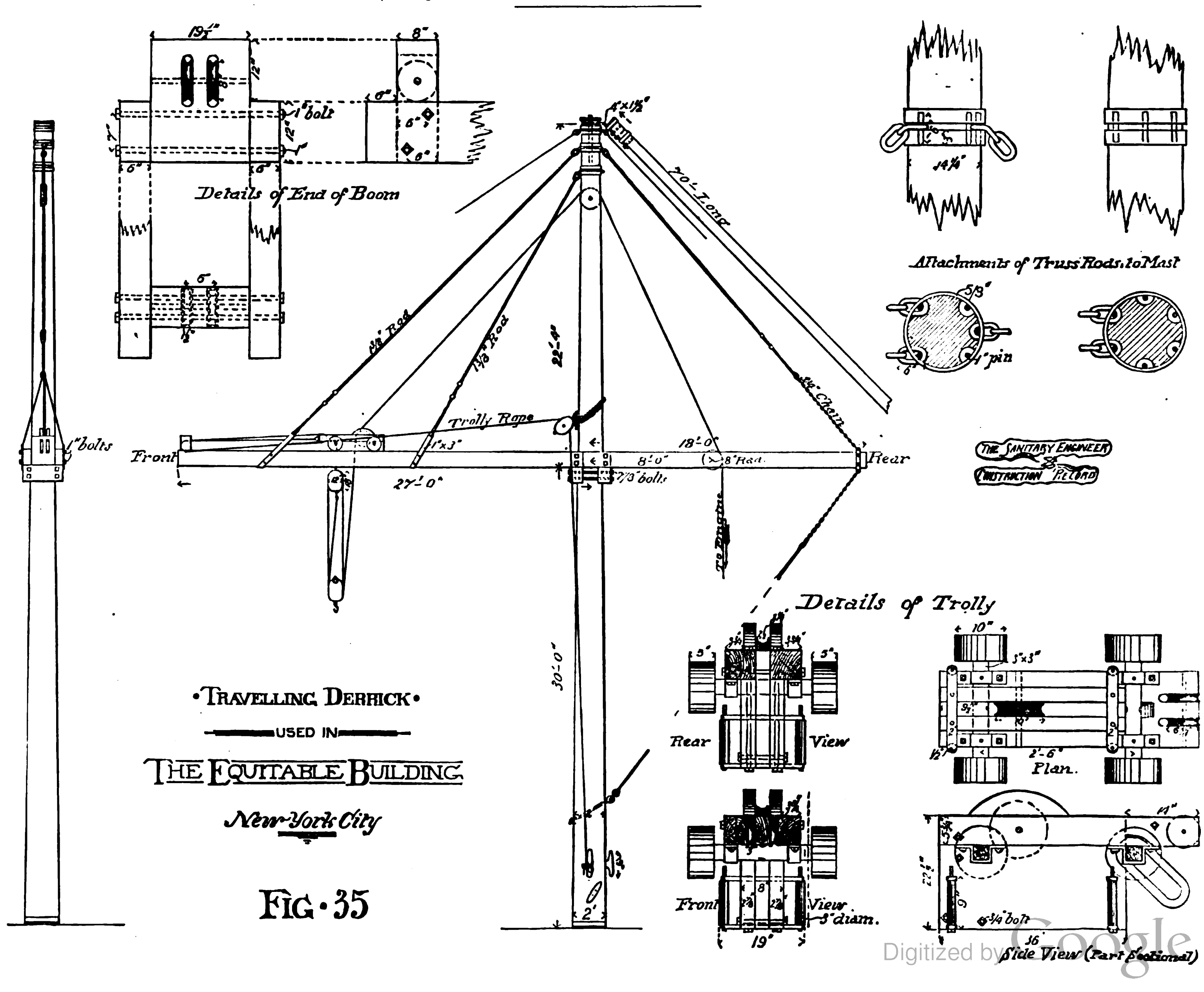


FIG. 35

thence back to the second sheave in trolly, out to the second end one, and from there back to a snatch-block and down to a cleat on the mast. As the resultant from the load tends to run the trolly in, by slacking off on this rope the load can be run in to any desired point. Except for very heavy loads, a single rope from the trolly to the boom end and back is entirely sufficient, and saves overhauling so much rope. The rollers at the sides of the trolly pass between the sticks of the boom, and are found to assist greatly in producing smoothness of movement.

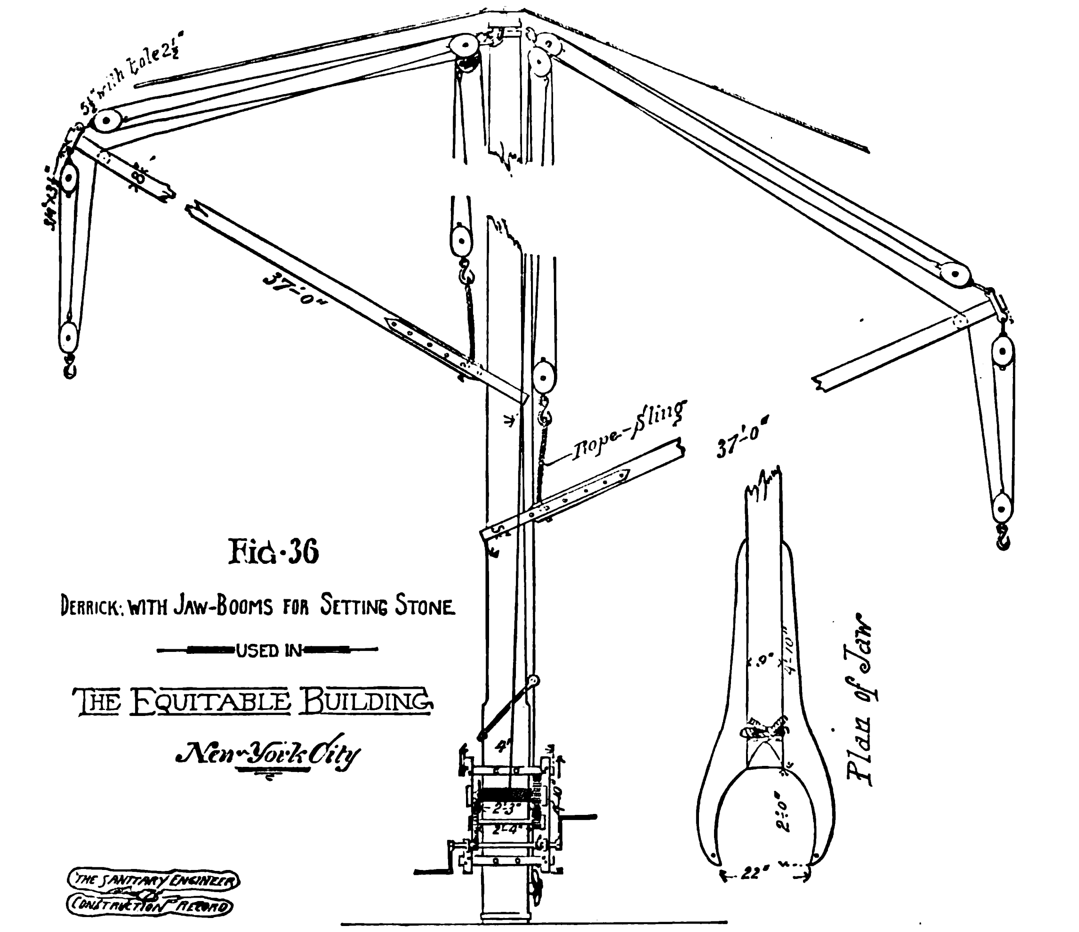
The blocks attached to the mast and supporting the boom are clasping the mast only, the object being to preserve the strength of the mast intact.

The guy and truss-rod attachments to the mast are novel, simple, and effective. The forging is reduced to that of plain rings, and is cheaper and much less liable to be imperfectly done, than where ears, etc., are made. Another advantage is that abundance of room is given for manipulations, as everything is not crowded together at the extreme end of the mast. The attachment at the upper end of the brace looks weak, but seems to have done its work well.

For the sake of clearness we have omitted another set of attachments to the same derrick, shown in Fig. 36. These consist of one or sometimes two so-called jaw-booms for stone-setting and two sets of wheel-work, with drums (one behind the other) for doing the hoisting. The main boom serves the purpose of hoisting the long distance from the street, but is fixed in position. Now if the derrick were made to swing it could keep but one setting gang at work, and would also cause a loss of time at the end of each operation of setting a stone, which would nearly equal that required for hoisting. By using the jaw-booms the stone is taken at once from the main boom and is set at any point within a radius of 37 feet. This releases the main fall for use in hoisting another stone. It will be noted that both the heel and peak of the boom are under control, the ropes being run to cleats on the mast.

The other derricks will be illustrated in our next issue.

(TO BE CONTINUED.)



FIG·36

DERRICK: WITH JAW-BOOMS FOR SETTING STONE

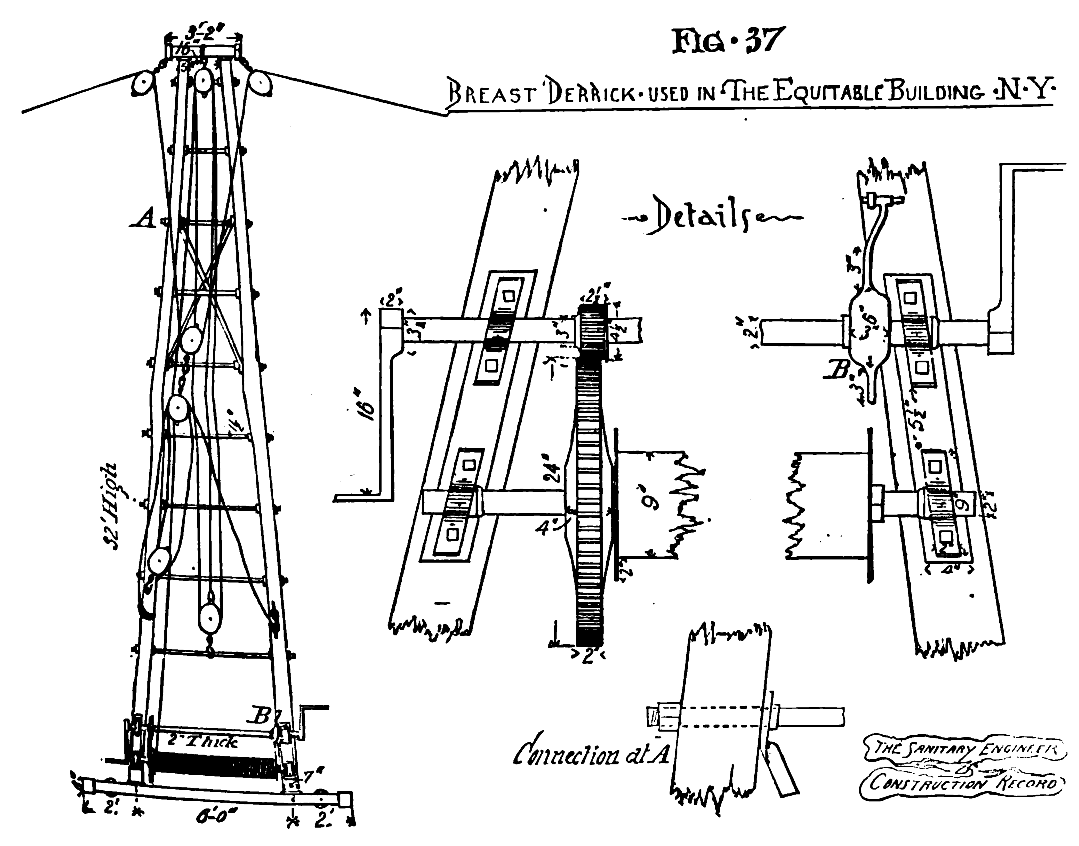
USED IN

THE EQUITABLE BUILDING

New-York City

FIG·37

BREAST DERRICK·USED IN THE EQUITABLE BUILDING ·N·Y·



SEWERAGE OF LAKEWOOD, N. J.

THE village of Lakewood, N. J. (formerly Bricksburg), on the New Jersey Southern Railroad, thirty-two miles from Sandy Hook, has within a few years become quite a populous winter resort, but, until the present season, has had no public water-supply or drainage. The principal hotel obtained its water from a deep artesian well, and discharged its sewage into a stream near by. Smaller hotels and private houses drew their supply from surface-wells, and returned it to the soil about the houses in the usual country fashion, except one public-house and one or two cottages near it, which had a subsurface disposal system.

To encourage the development of the place, the proprietors of the principal hotel, who also own most of the land in the vicinity, wisely decided to construct systems of public water-supply and drainage at the same time, and both works were completed during the past warm season, when the hotels were closed, and the village nearly deserted, except by the few permanent tradesmen and mechanics.

Since the creek flowing past the village was not used for water-supply below (in its course of about eight miles to Barnegat Bay), and was a rapid stream of considerable volume throughout the year, as it drained a large area of wooded territory, it was decided, for the present at least, to discharge the sewage into it without treatment at a point about a thousand feet below the present limit of the village, opposite a tract well suited for broad irrigation, should it seem advisable to adopt that method of disposal in the future.

Pipe-sewers were used throughout, all eight inches in diameter, except the intercepting line from the intersection of the several systems to the catch-basin (about 1,200 feet), which is 10-inch. They are designed to carry only house-sewage, storm-water being easily disposed of in the sandy soil and surface-gutters to the creek. Six-inch Y-branches were inserted opposite every house, and wherever one was likely to be built, and the ends closed with terra-cotta plates, fastened in with clay, covered with cement. The principal hotel has two 8-inch connections.

Manholes were placed at every street intersection, and also half-way between wherever the streets were over 400 feet apart, and lamp-holes (coming only to within a foot of the surface, and covered by a stone and earth), half-way between the manholes. Through the manhole-chambers the sewage flows in open semi-cylindrical channels of cement, and all changes of direction and grade are made in the same. In most of the sections between manholes the total variation from a perfectly straight and circular cylinder (as seen by looking through from one to a light in the next) does not amount to more than two or three inches, and in none does it amount to much more than half the diameter of the pipe.

It was designed to have all manholes ventilated, but the proprietors would not allow this at about half of the number (in the most frequented situation) for fear of giving offense. Those ventilated have perforated-iron covers, with galvanized-iron buckets beneath. Ventilating lamp-holes are placed at the heads of all branches, and these are flushed through the same openings by removing the covers and inserting hose. The main lines are flushed from tanks (having ventilating covers) at their heads.

The minimum grade is .004 (four-tenths of a foot in one hundred feet), which is found in the greater portion of the system. The cuttings vary from three and a half to twelve feet. The nature of the soil (fine compact sand) was such that no timber bracing was required, but in cuttings of more than four feet the excavation was made in sections of from 15 to 20 feet, with division-walls (of earth) two feet thick between, through the bottom of which arched tunnels were cut large enough for the pipe-layers to crawl through. These division-walls served the purpose of braces to prevent caving, and of bridges for crossing the ditch, and observing and inspecting the accuracy of alignment, and were also used as points for grade and alignment stakes, the method being to drive stakes (or iron spikes where the surface was very hard—none of the streets were paved) every 15 or 20 feet on the centre line, to serve both for alignment and levels. The bottom of the trench was made true to grade by the use of a straight edge about 17 feet long, to the middle of which was attached an adjustable level which was set by the engineer to correspond with the grade at every change. Vertical measurements by the pipe-layers were made from the stakes or spikes on the division-walls by a rod having

a sliding clamp, by holding one end of a carpenter's level on the top of the spike and the other on the clamp.

The pipe alignment was secured by the use of a plumb-bob suspended by a line sliding on a cord stretched between the spikes, and a semi-circular disk of thin board made to fit in the bell of the pipe, and having a notch in the middle of its straight edge.

The catch-basin is an elliptical chamber with a bottom shaped much like half an egg-shell, the extreme dimensions being 6x9 feet, the longest dimension being in the direction of the flow, and 5 feet deep. The bottom of the inlet-pipe (10-inch) is about 18 inches below the top, and the bottom of the outlet (8-inch) about 2 feet below the top of the basin. A wrought-iron strainer, with vertical bars ⅜x1¼-inch, one inch apart, is set about three feet from the outlet, at right angles to the flow, designed to catch the paper, etc., to be removed by a rake with teeth fitted to the bars. The rounded bottom and sides were designed to make the basin self-cleaning during flushes, and prevent the deposit or accumulation of any matter other than that to be retained by the strainer. From the outlet-basin to the stream the sewer is laid across a swamp on plank supported on piles. The outfall is carried into the middle of the current by an iron pipe ending below the low-water surface, protected by piling.

The total length of sewers constructed thus far is about 13,000 feet.

The work was done under contract by Mr. George Olcott, of Orange, N. J., after plans and under the supervision of Mr. Dana C. Barber, civil engineer, of Philadelphia. Mr. Rudolph Hering, of Chicago, was consulting engineer for the work.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE American Society of Civil Engineers held their annual meeting last Wednesday.

Reports were read from the Board of Direction and the Treasurer, showing that the society is in a flourishing condition, and steadily growing in numbers and influence.

The Norman medal for the year was awarded to Mr. Edward Bates Dorsey, member of the society, for his paper on "English and American Railways compared."

The Rowland prize was awarded to Mr. Charles C. Schneider, member of the society, for his paper entitled the "Cantilever Bridge at Niagara Falls."

The committee on "Uniform Standard Time" made an interesting report on the progress of the movement for its adoption, with particular reference to the Canadian Pacific Railway. This company have given it about a year's trial on their western division and branches, comprising altogether 2,600 miles of road. Letters were read from conductors, train dispatchers, superintendents, and Assistant General Manager, all enthusiastic in its praise. Also from the Manitoba Printing Co. and others. They all spoke of its simplicity, absolute freedom from ambiguity in orders, and consequent increase of safety to passengers and traffic, of its ready adoption by the public, its great advantages in the movement of trains, etc., and they all desire its adoption over the whole line and connecting roads. It is understood that the Canada Pacific will within the year to come adopt the new method over its whole line.

The society passed resolutions recommending Mayors of cities to have clock-dials on public buildings arranged for its use, and that the post office authorities also recognize it in an official manner. The committee was continued.

The committee on the "form of rails and car-wheels" presented a short report and was continued.

The committee on compression of cement-mortar, etc., under strain, made a report of progress, and referred to important information, soon to be published, which has been obtained from tests made at the Watertown Arsenal.

The place of the next convention was discussed, and the feeling strongly expressed that it was not desirable to meet in a large city.

Newport, Saratoga, the Thousand Islands, Old Point Comfort, etc., were all suggested, and a resolution passed referring the matter to the Board of Direction, with the proviso that the place selected shall have a hotel large enough to accommodate all who may attend, and that it shall not be near a large city.

The result of ballot for officers was then announced as follows:

President, William E. Worthen; Vice-Presidents, Thomas C. Keefer, Thomas F. Rowland; Secretary, John Bogart; Treasurer, J. J. R. Croes.

Directors—William G. Hamilton, Charles C. Schneider, Stephenson Towle, James Archibald, Robert Forsyth.

The remainder of the proceedings were of a scientific nature, including a short discussion on corrosion of cast and wrought iron pipes, and a very interesting paper by Mr. Charles Macdonald, Mem. Am. Soc. C. E., on a 600-ton testing-machine, with a lengthy discussion. Our account of this and the excursion on Thursday must be deferred until next week. The following were in attendance at the different sessions so far as reported:

William E. Worthen, Theodore Cooper, J. J. R. Croes, J. W. Adams, William G. Hamilton, General George S. Greene, George S. Greene, Jr., Charles Macdonald, A. M. Wellington, George S. Morrison, Stevenson Towle, Charles E. Emery, C.C. Martin, Robert L. Harris, E. L. Corthell, all of New York; A. H. Emery, Stamford, Conn.; Thomas H. McKenzie, Southington, Conn.; C. G. Force, F. B. Aspinwall, E. P. North, George H. Bishop, F. O. Whitney, C. A. Wilson, F. M. Knapp, C. W. Hunt, A. B. Paine, Miller A. Smith, B. D. Hassell, S. S. Wheeler, P. F. Nicholls, C. E. Jackson, W. H. Paine, J. O. Osgood, J. S. Elliott, A. B. Seaman, George Harding, W. F. Booth, J. P. Davis, D. H. McKenzie, F. Collingwood, C. M. Kelly, F. H. Baldwin, H. S. Goodwin, J. P. Pulman, C. C. Schneider, C. D. Ward, B. F. Richardson, F. A. Purdey, C. B. Brush, E. B. Westen, A. Beardsley, S. Rea, E. Sherman, W. J. Haskins, S. F. Shelbourne, P. R. Gates, C. M. Harris, Fred. Graff, J. Fletcher, S. S. Wheeler, J. S. Elliott, W. F. Booth, E. R. Andrews, E. S. Safford, G. F. Simpson, M. M. Tidd, H. Loomis, A. J. Zabriskee, F. M. Leavitt, M. Putnam, E. B. Van Winkle, J. R. Richards, H. Bissell, A. F. Noyes, S. S. Wheeler, C. A. Ferry, J. R. Freeman, G. A. Kimball, M. J. Butler, A. B. Hill, H. C. Parsons, C. Fisher.

BOSTON SOCIETY OF CIVIL ENGINEERS.

AT a regular meeting of the Boston Society of Civil Engineers held January 19, Vice-President L. Fred. Rice in the chair, H. L. Eaton, Secretary, Mr. George W. Blodgett read a paper on the steam-engine in electric-lighting. Mr. L. Fred. Rice alluded to some problems in construction met with in practice, including the Green River Bridge, Troy and Greenfield Railroad.

WATER-SUPPLY IN QUEENSLAND.

THE Queensland Water-Supply Department is forming two large tanks on the Winton and Boulia road. Contracts have been let for six other tanks on the same road, and the contractors are expected to start work at once. A tank is in progress on the Woolgar and Richmond road at Burnt Yards Creek, also one on the Hughenden and Muttaburra road at Landsborough Creek. On the Hughenden and Winton road the tanks at Bourke's and White Woodbridge are nearly completed. These tanks, when completed, will hold between 4,000,000 and 5,000,000 gallons of water, being 27 feet deep by 120 yards by 80 yards across. A steam-pump has been erected at Bradley's Creek shaft, near Muttaburra, on the Winton road, and a bore has been completed at Bangall Creek, which is on the same road, about twelve miles from Muttaburra. The depth of this bore is 296 feet, and the yield of water 3,300 gallons per twenty-four hours; the water rises to within 66 feet of the surface. The machine which was at Bangall Creek is now being removed to the Jericho and Blackall road, where a bore is to be put down at the centre of the dry stage-road. A twelve-mile bore on the Winton and Boulia road, and Stack's Bore on the Winton and Hughenden road, are both progressing satisfactorily. A bore at Mamtam Creek on the Hughenden and Muttaburra road is nearly finished. An American boring-machine at Blackall is now down 800 feet, and has about 700 feet of 10-inch tubing down; the bore has been passed through hard blue shale, and until this changes there will not be much chance of tapping any artesian supply. Most of the works in the West have recently been fenced, and wherever necessary a caretaker has been appointed. Surveys have recently been made of the western and north-western roads.—*London Engineering.*

RAILROADING UNDER THE SEA.

THE first passenger trains passed through the gigantic tube linking the shores of Monmouthshire and Gloucestershire on Wednesday morning. Before those on board quite knew where they were a shrill whistle, a sudden darkening—for it was now nearly broad daylight—and "We are in!" told them they were "in" and rushing down a clearly perceptible decline toward a point a hundred feet below the bed of the broad estuary. In a trice watches were out and windows down, the first to keep time, the other to test ventilation. The inrush of icy cold air, as clear and pure as the trip across was being made in the old way—over instead of under the Channel—showed the latter was all right. The submarine journey—if such it may be called—proved to be more like a run through a pretty deep cutting than through a tunnel four and a quarter miles long. For about three minutes and a half after entering there was no mistaking the fact that a sharp gradient was being descended, then a momentary rumble as the train passed over the curve of the arc—for the tube dips in the centre—and then the locommotive, at an ever-decreasing speed, climbed the opposite gradient, to emerge once more into daylight in 8 minutes and 49 seconds.

As before remarked, the ventilation of the tunnel is little short of perfect. During the construction of the work a fan 18 feet in diameter, discharging 60,000 cubic feet of air per minute, was used. This has now been replaced by a fan 40 feet in diameter and 12 feet wide, made on the same principal as those used at the Mersey and a portion of the Metropolitan tunnels. The tunnel is 26 feet wide and 20 feet high from the double line of rails to the crown of the arch inside the brick-work. The rails are laid on longitudinal sleepers. The tunnel has been lined throughout with vitrified bricks set in cement, and no less than 75,000,000 bricks have been used in this work. This vitrified brick wall has a thickness of 3 feet in the crown of the arch beneath the "shoots," but as the tunnel rises from this lowest point on a gradient 1 in 90 one way and 1 in 100 toward the Glouscestershire side, this thickness is gradually reduced to 2 feet 3 inches.—*Cardiff, Wales, Weekly Mail.*

THE ENGINEERS OF THE LIME-KILN CLUB REPORT ON THE CONDITION OF THE STOVE.

THE Committee of Civil Engineers appointed to make a survey of the stove and report its exact condition now reported through its chairman that they had discovered the following injuries:

Loss of two legs and a compound fracture of a third. Two crevasses extending the entire length of the base, in an erratic manner. One door-hinge carried away, the hearth broken in three places, and the door very much demoralized by a collision. The port-side cracked in five places and the starboard in six, while the stern had been badly wrenched by getting aground. In their opinion Paradise Hall was in danger of being destroyed every time a fire was started in the stove. The committee was dismissed from further consideration of the subject, and Trustee Pullback and Whalebone Howker were appointed a new committee to look around and report prices on another stove.

Samuel Shin moved that they be instructed to buy one with an angel in bronze on the top, and that it should not be less than four-horse power, but he was promptly ordered down and fined $400, and the committee was left to use its own discretion.—*Detroit Free Press.*

OIL UPON THE WATERS.

THE pilot chart of the United States Hydrographic Office for December contains the experience of a ship captain on the effect of pouring oil upon the sea in calming the waves. The captain writes: "September 21, 1886, standing to the southward in the Gulf Stream, had a gale from west north-west, wind and sea abeam. Vessel making nine knots good. As the sea increased, the combers striking the vessel on the weather side would shoot high in the air, and then, coming on board, filled the decks with water. Captain Smith had read accounts in the Hydographic Office publications, but had never attempted the 'use of oil,' nor did he have much belief in its efficacy. Wishing to take advantage of the favoring gale, and at the same time not endanger the vessel, he determined to try the experiment. The mate was of the same opinion as the captain, and scouted the idea of any service resulting from its use. A canvas bag, filled with oil (in the proportion of one quart of paint oil to two quarts of paraffine), was placed in the bowl of the weather-closet forward, through the pipe of which the oil dripped on the sea. By the time the oil reached the main channels (where most of the water had come on board) it had spread and formed a 'slick' thirty feet to windward. The result was as satisfactory as it was unexpected; the breaking combers on reaching the 'slick' were reduced to harmless swells, over which the vessel rose without, as before, taking volumes of water on board. The gale continued for twenty-four hours, during which, by a continuous use of oil (expending three quarts every four hours), the 'Wallace' was enabled to keep the course desired, and at no time was the speed reduced to less than eight knots; and, though the sea continued high, the oil prevented the combers from breaking on board. This report demonstrates that oil can be of practical service when reaching ahead at the speed of eight or nine knots, with a beam wind and sea."

[It appears probable that the oil acts as a lubricant, and also forms a coating with a certain cohesiveness which prevents or diminishes the breaking up of the crest of the wave.—ED.]

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

THE HEATING AND VENTILATION BY HOT WATER OF THE STATE, WAR, AND NAVY DEPARTMENT BUILDING IN WASHINGTON, D. C.

THE warming of many of the United States buildings in Washington, D. C., and Federal buildings throughout the country is by hot water. Though engineers who are especially interested in large heating-works have found time to visit wings, the centre being supplied from the west wing. The south wing was commenced in 1871, and took three years to build. The east wing was finished in 1878, the north in 1883, and the west and centre was commenced in 1884, and is now nearing completion.

The cellar of the building is principally given up to the warming and ventilating apparatus. The remaining floors of the building, which consist of basement, first, second, third, and fourth floors, are for offices. The partition-walls of the cellar show the general plan of the offices, but provision is made for extra partitions by iron girders, and the heating is also arranged with the same view, so that the large offices can be divided into smaller ones if necessary. The warming of the basement and first floor is by direct-indirect radiation. The remaining floors, second to fourth inclusive, are warmed by indirect radiation.

Figures 2 and 3 are sections through the direct-indirect masonry just above the belt course. Here the cast-iron top of the coil-casing rests on the window-sill, and a galvanized-iron sheathing is carried an inch or so from the wall to form the back of the case. Figure 4 gives the detail of the damper used with this method of taking the air in. Figure 6 shows the metal drip-pans that are used under all the coils. About ⅛-inch wrought-iron bottoms are used, about which is riveted an angle-iron edge 1½ inches high. Each pan has a ½-inch syphon-trap attached to it by a pipe of sufficient length to reach into the cellar. The traps are at the cellar ceiling and the lower end is open, so leakage can be detected by the engineer as he passes through the cellar. The object of the trap is to prevent odors or currents of air from passing from the cellar to the offices.

At R, Figs. 2 and 3, in the coil-casings are sliding dampers. When it is desirable, they can be left open for the

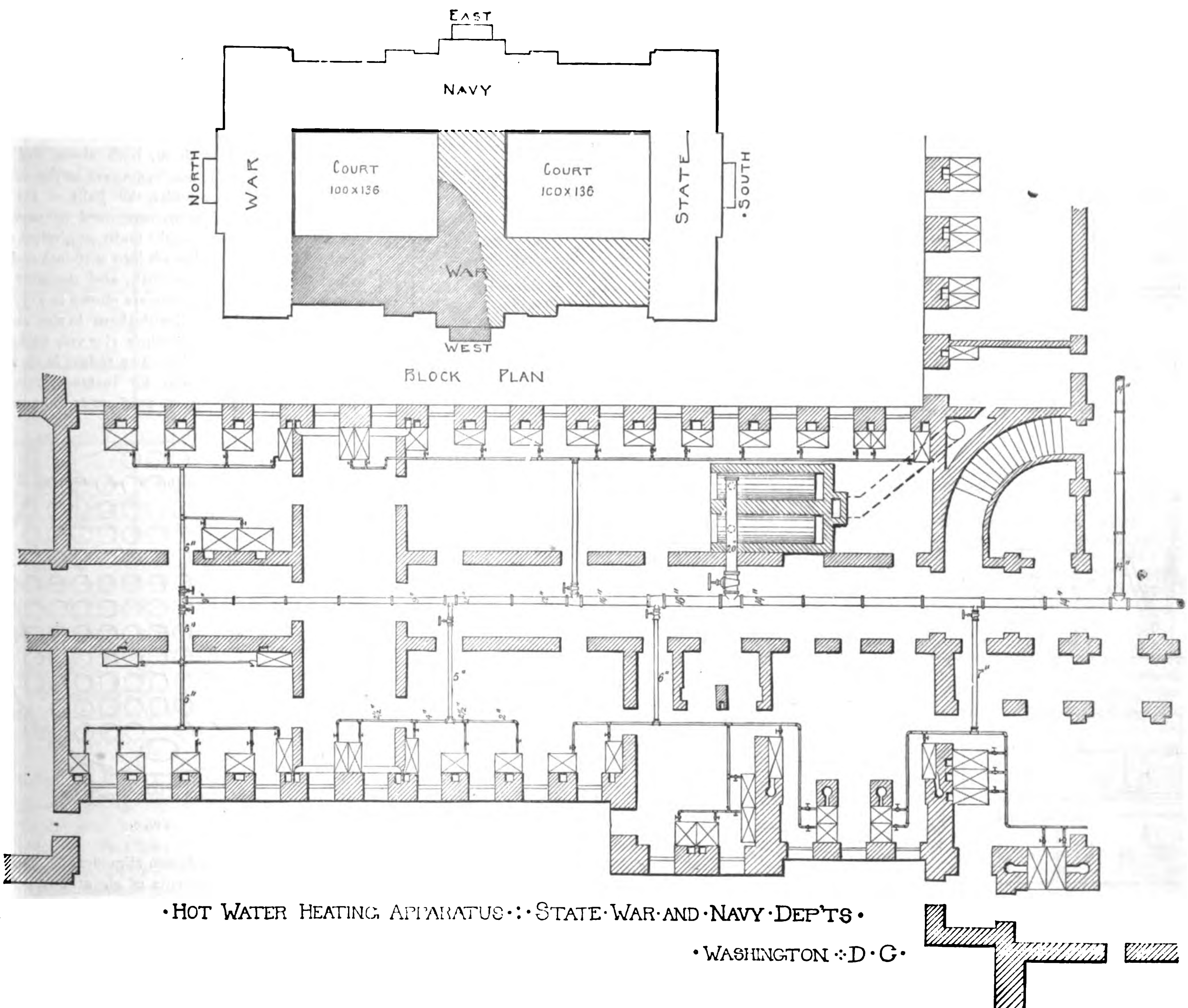


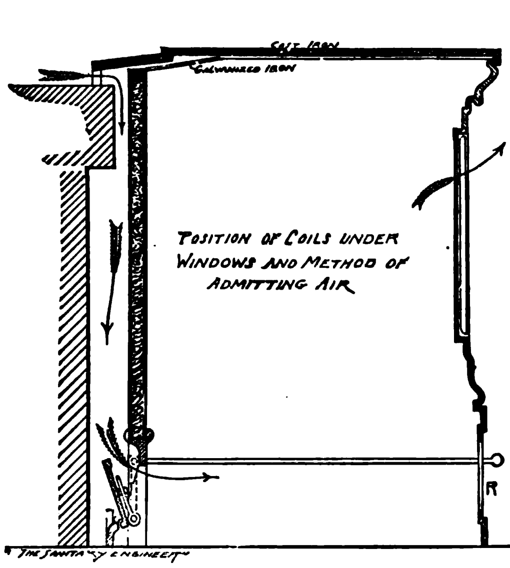
FIGURE 1.

many of these buildings and become conversant with their details, the greater number who do heating and the public generally have not the time nor opportunity. We therefore give some sketches and details of the apparatus lately put into the new wings of the State, War, and Navy Department Building, for which we are largely indebted to Col. Thomas Lincoln Casey, U. S. A., Engineers, under whose direction the work was done, who gave us access to the drawings.

The building is 500 feet long from north to south, and 275 feet from east to west. The centre and west wing (War Department), shown by shade lines on the block plan (Fig. 1), comprises the new part of the building. The darker shading comprises that part of the building shown in enlarged detail in the same figure, which has within it a set of boilers and a warming-apparatus. Within the entire building there are six such apparatus, one in the north and one in the south wing, and two in each of the east and west coil casings under the windows. The coils are box-coils, and those for direct-indirect heating are principally 1½-inch wrought-iron pipe. Figure 2 is a section of the method used on the basement floor for the admission of air, and Fig. 3 the method used on the first floor. In the case of Fig. 2 the air is taken in above the stone sill of the window and passed under the edge of the cast-iron top of the coil-casing and carried to the cold-air dampers between an apron and the wall; the apron forming the back of the coil-casing or chamber. The apron and cold-air damper is shown in detail in Fig. 4. The apron is two sheets of metal filled between with hair felt about 1½ inches thick and riveted at the edges with stay-bolts in the middle at suitable places to keep the non-conducting materials in place. Where an apron is used it will be noticed the damper opens outward, while in other cases it opens inward. In the case of Fig. 3 the air is taken directly through the wall, long openings being left in the air of the room to circulate against the coils, and the cold-air inlet can be closed.

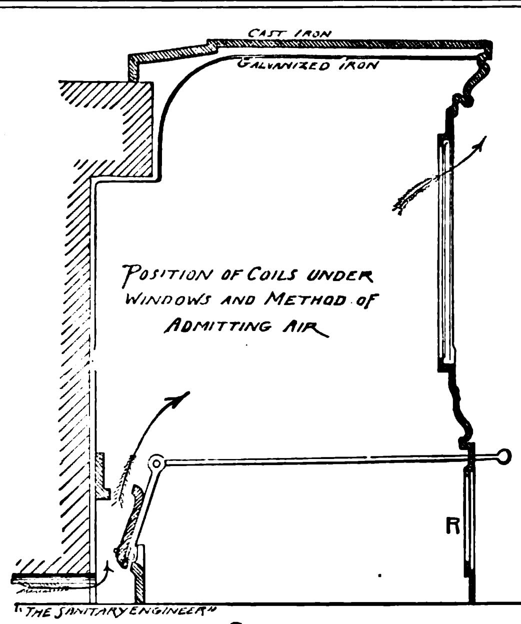
Figure 7 shows the cold air inlets for indirect coils both in plan and section, and otherwise shows the brick coil-chamber for the indirect coils and the flues. The positions of these coils are indicated on the basement plan, Fig. 1—thus: |⊠| The air is taken through a strong cast-iron grating beneath a false window-sill of stone, as shown in section C D, Fig. 7, thence down through dampers shown plainly in section A B and plan, where it enters the coil-chamber to be warmed on its way to the flue.

Figure 8 shows the indirect coil which is suspended within the coil-chamber on T-iron built into the walls. They are made of cast-iron pipes three inches in diameter, with cast-iron headers. The pipes are set with 5-inch centres in both directions and the joints are made with hemp rope-yarn saturated with lead paint, driven tightly in with a hand tool. The connections (flow and return pipes) are



SECTION

FIG 2.



SECTION

FIG. 3.

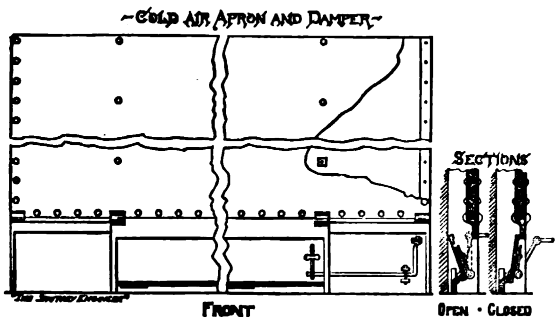


FIG. 4.

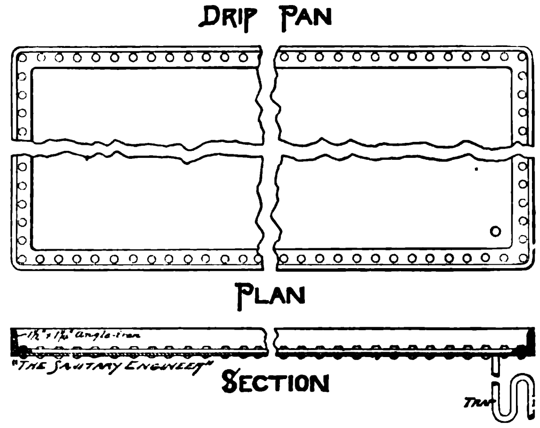


FIG. 6.

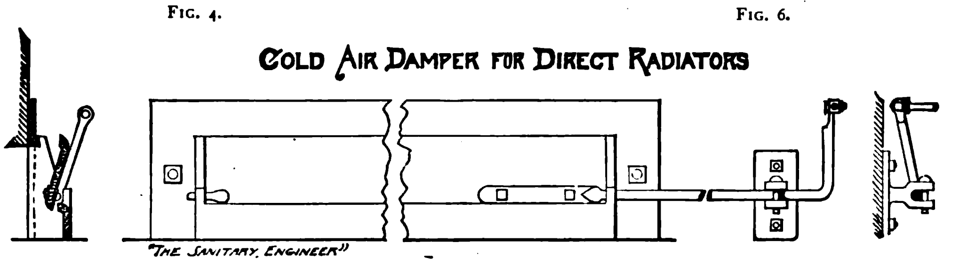
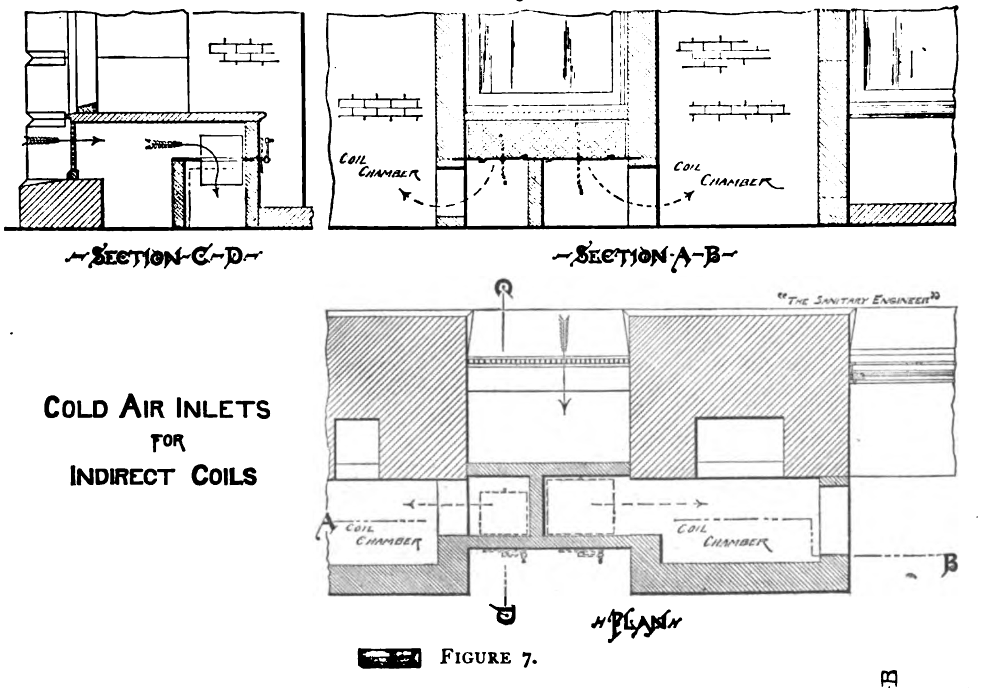


FIGURE 5



COLD AIR INLETS FOR INDIRECT COILS

FIGURE 7.

2½ inches in diameter. The chambers are built of brick with 8-inch walls and run to the ceiling of the cellar. The valves are ordinary gate-valves, and one is used on both flow and return pipe, the object of the second valve being to enable it to be shut off for repairs without interrupting the remainder of the apparatus

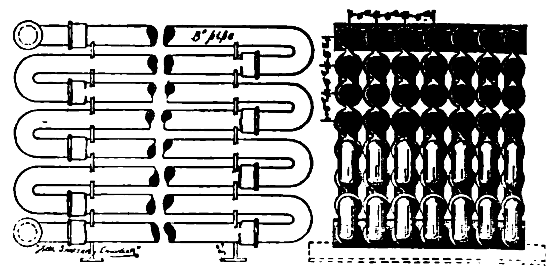
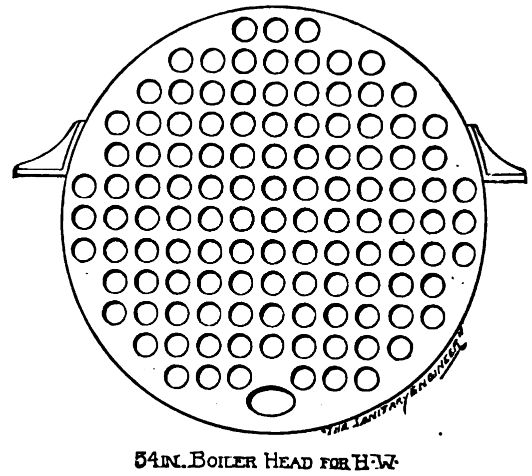


FIG. 8.

or drawing the water from it. The boilers used are full of tubes, as shown in Fig. 9. They are 54 inches in diameter, and contain 121 3-inch tubes, and 60-inch boilers used in other of the plants of the building have 148 3-inch tubes each. Fourteen-inch cast-iron necks join the boilers with a 20-inch cross drum, both above and below, as shown in Fig. 10. These drums are carried full size into the main passageway under the halls of the building. Twenty-inch gate-valves are here used as seen in Fig. 1, basement plan. They are the main stop-valves of a single plant. The pipes then branch into a 16-inch and a 14-inch main; the former running north, and the latter south and central. The flow-pipes only are shown in Fig. 1, but the return-pipes are identical with them in size and may be seen in Fig. 11. The flow-pipes rise very slightly as they go from the boilers. Where they reduce in diameter from a large to a smaller size—as, for instance, from 16 to 14 inches—eccentric fittings are used, so as to have the top of

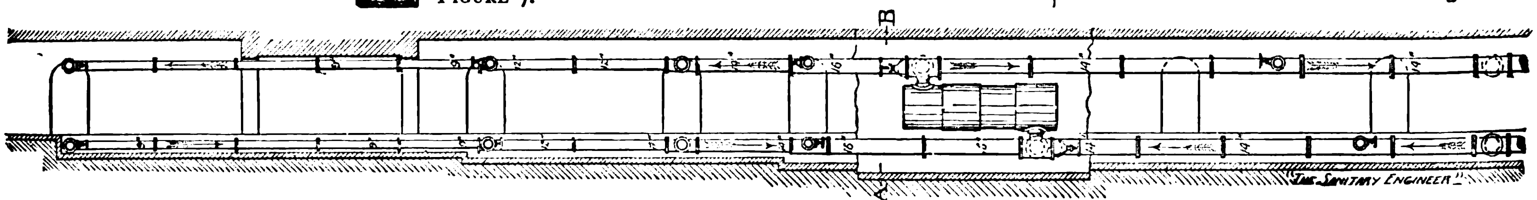


54 IN. BOILER HEAD FOR H.W.

FIG. 9.

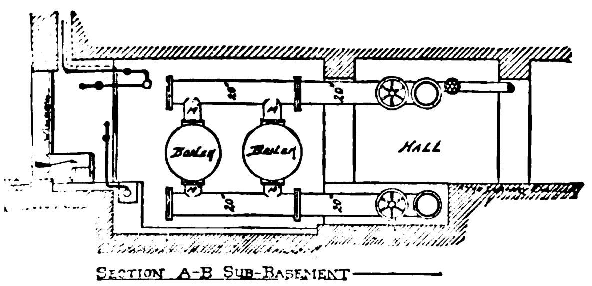
the pipe on the same common alignment. This is to prevent air-traps or lodgments of air at any point of the pipes. This can be noticed in Fig. 11. The branches from the mains are also taken out on a level with the top of the main through special eccentric branch-*tees*, the object being the same. This can be seen in Fig. 10.

Figure 12 is a diagram showing the sizes of the rising lines. When short it will be noticed they are of large diameter, but when long they are not much larger than would be used for steam. The first riser to the right supplies coils on basement and first floor. It is a 3-inch pipe to the basement floor, with a 2-inch branch, and 2 inches to the first floor, while the return pipe is the same, with the exception that it runs to the cellar floor. The second riser is 2½ inches to the first floor and 1¼ to the fourth floor, with a 2-inch branch at the first-floor level. The third riser is 1¼ inches to the first floor to a comparatively small coil, while the fourth one is 2 inches to a large coil. The ex-



SECTION THROUGH HALL OF WEST-WING
SUB—BASEMENT
FIGURE 11.

pansion-tank is near the roof and is of small capacity, the excess of water running into the overflow, when heated up. When cooling and contraction takes place the ball-cock opens and makes up the deficiency from the city



SECTION A-B SUB-BASEMENT

FIG. 10.

water-supply. The tank is connected with the return pipe and is for the purpose of expansion and water-supply alone, while the air is drawn off at air-cocks on the pipes and coils.

The apparatus was designed by Bartlett, Hayward & Co., of Baltimore, and the contractors for materials were the Walworth Manufacturing Co., of Boston, and Samuel

DIAGRAM SHOWING SIZE OF RISING LINES FOR HOT WATER STATE, WAR AND NAVY DEP'TS

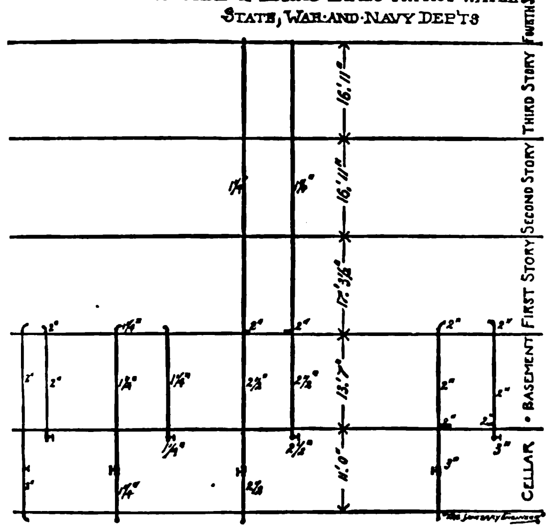


FIG. 12.

Pope & Co., of Chicago, while the workmen were supplied and the apparatus superintended by Mr. Chas. W. Newton, of Baltimore. We have also been indebted to Mr. Bernard Green, (Chief Assistant to Col. Thomas Lincoln Casey,) for courtesies extended to us while making an examination of the building.

ROCHESTER, N. Y., PLUMBING REGULATIONS

THE following are the regulations governing plumbing adopted by the local board of health, in accordance with Chapter 402, New York laws of 1886:

I.—*The Registration of Plumbers.*

RULE I. Every plumber engaged in business in the city of Rochester shall appear in person at the Health Department and register his name and address, with the Clerk of the Board of Health, pursuant to the provisions of chapter 402, laws of 1886, upon the forms prescribed by the Health Department.

II.—*Of Plumbing.*

The law requires that the plumbing and drainage of all buildings, public and private, shall be executed in accordance with plans and specifications previously approved in writing by the Board of Health; and that suitable drawings and descriptions of the said plumbing and draining shall, in each case, be submitted and placed on file in the Health Department.

Blank abstracts of the specifications for plumbing and drainage will be furnished to architects and others, on application at the Board of Health office.

As the law requires that the plumbing and drainage to be executed according to a plan approved by the Board of Health, no part of the work shall be covered or concealed in any way until after it has been examined by an Inspector of Plumbing of the Board of Health; and notice must be sent to the Board when work is sufficiently advanced for such inspection.

After a plan has been approved, no alteration of the same shall be allowed except on the written application of the owner.

III.—*Plan of Drainage and Plumbing Approved by the Board of Health.*

1. All materials must be of good quality and free from defects; the work must be executed in a thorough and workmanlike manner.

2. The drain, soil, and waste pipes, and the traps, must, if practicable, be exposed to view for ready inspection at all times, and for convenience in repairing. When necessarily placed within partitions or in recesses of walls, soil and waste pipes must be covered with wood-work so fastened with screws as to be readily removed. In no case shall they be absolutely inaccessible.

Shafts not less than three square feet in area are required in tenement-houses, to ventilate interior water-closets, or in a manner designated by the Inspector of Plumbing, subject to the approval of this Board.

3. Every house or building must be separately and independently connected with the street sewer.

4. When there is no properly constructed or available sewer in the street, and it is necessary to construct a private sewer to connect with a sewer on an adjacent street or avenue, application must be made to this Board for permission so to do.

5. The house-drain must be of iron or tile pipe of good material, with a fall of at least one-quarter inch to the foot.

6. It must be hung on the cellar wall or ceiling, unless this is impracticable, in which case it must be laid in a trench cut at a uniform grade, provided with necessary hand-holes.

7. It must be laid in a straight line, if possible. All changes in direction must be made with curved pipes, and all connections with Y-branch pipes and one-eighth bends.

8. Any house-drain or house-sewer put in and covered without due notice to the Health Department, must be uncovered for inspection at the direction of the Inspector.

9. A running or half-S trap must be placed on the house-drain at an accessible point near the front of the house. This trap must be furnished with a hand-hole for convenience in cleaning, the cover of which must be properly fitted and made gas and air tight with some proper cement.

10. There must be an inlet for fresh air entering the drain just inside the trap, of at least four inches in diameter, leading to the outer air and opening at or near the street curb, provided with a suitable cap.

11. No brick, sheet-metal, earthenware, or chimney flue shall be used as a sewer-ventilator, nor to ventilate any trap, drain, soil or waste pipe.

12. Every vertical soil-pipe and waste-pipe must be of iron, and where it receives the discharge of fixtures on two or more floors it must be extended at least two feet above the highest part of roof or coping, of undiminished size, with open or basket end. It must not open near a window, nor an air-shaft which ventilates living-rooms.

13. Soil, waste, and vent pipes in an extension must be extended above the roof of the main building when otherwise they would open within twenty feet of the windows of the main house or the adjoining house.

14. The minimum diameter of soil-pipe permitted is four inches. A vertical waste-pipe, into which a line of kitchen sinks discharge, must be at least two inches in diameter, with one inch and a half branches.

15. Where lead pipe is used to connect fixtures with vertical soil or waste pipes, or to connect traps with vertical vent-pipes, it must not be lighter than D-pipe.

16. All iron pipes must be sound, free from holes, and of a uniform thickness of not less than one-eighth of an inch for a diameter of two, three, or four inches, or five-thirty-seconds of an inch for a diameter of five or six inches; and in case the building is over sixty-five feet in height above the curb, the use of what is known as Extra Heavy Pipe and corresponding fittings are required.

17. Before they are connected they must be thoroughly coated inside and outside with coal-tar pitch, applied hot, or some other equivalent substance.

18. When required by a Plumbing Inspector from the Board of Health, the plumbing must be tested with the water test, by the plumber in the presence of the plumbing Inspector, and all defective joints made tight, and other openings made impermeable to gases. Defective pipe discovered must be removed and replaced by sound pipe. Stop-cocks shall be placed at the foot of the vertical soil or waste pipes for the convenience of the Plumbing Inspector.

19. All joints in the iron drain-pipes, soil-pipes, and waste-pipes must be so calked with oakum and lead as to make them impermeable to gas.

20. When tile is used for the house-drain, it must be laid in a trench cut to a uniform grade and the soil well rammed to prevent settling. The ends of pipe must first be wetted and the space between hub and end of next section of pipe be completely filled with the best quality of hydraulic cement. A scraper or wiper must be used after the cement is applied to each joint and before the next section is laid, to remove any cement that may have been forced into the pipe. Every tile drain inside of house must be filled with water and so shown to Inspector of Plumbing.

21. All connections of lead with iron pipes must be made with a brass sleeve or ferrule, of the same size as the lead pipe, put in the hub of the branch of the iron pipe and calked in with lead. The lead pipe must be attached to the ferrule by a wiped or overcast joint.

22. All connections of lead pipe should be by wiped joints.

23. Every water-closet, urinal, sink, basin, wash-tray, bath, and every tub or set of tubs, must be separately and effectively trapped; except where a sink and wash-tubs immediately adjoin each other, in which case the waste-pipe from the tubs may be connected with the inlet side of the sink-trap; in such a case the tub waste-pipe is not required to be separately trapped.

24. Traps must be placed as near the fixtures as practicable, and in no case shall a trap be more than two feet from the fixture.

25. In no case shall the waste from a bath tub or other fixture be connected with a water-closet trap.

26. Traps must be protected from syphonage, and the waste-pipe leading from them ventilated by a special air-pipe, taken out of the crown of trap, in no case less than two inches in diameter for water-closet traps, and one inch and a quarter for other traps. The vertical vent-pipes for traps of water-closets in buildings more than four stories in height must be at least three inches in diameter, with two-inch branches to each trap, and for traps of other fixtures not less than two inches in diameter, with branches one and a half inches in diameter, unless the trap is smaller, in which case the diameter of branch vent-pipe must be at least equal to the diameter of the trap. In all cases vent-pipes must be of cast or wrought iron and connected to traps with brass soldering-unions.

27. These pipes must either extend two feet above the highest part of the roof or coping, the extension to be not less than four inches in diameter to avoid obstruction from frost, or they may be branched into a soil-pipe above the inlet from the highest fixture. They may be combined by branching together those which serve several traps. These air-pipes must always have a continuous slope, to avoid collecting water by condensation.

28. Every safe under a wash-basin, bath, urinal, water-closet, or other fixture must be drained by a special pipe not directly connected with any soil-pipe, waste-pipe, drain or sewer, but discharging into an open sink, upon the cellar floor, or outside the house.

29. The waste-pipe from a refrigerator shall not be directly connected with soil or waste-pipe, or with the drain, or sewer; it should discharge into an open sink. Such waste-pipes should be so arranged as to admit of frequent flushing, and should be as short as possible and disconnected from the refrigerator.

30. All water-closets within the house must be supplied with water from main supply or tank of sufficient size located above the same. A group of closets may be supplied from one tank. But water-closets on different floors are not permitted to be flushed from one tank.

31. When closets are supplied from tanks, the pipe to closet shall in no case be less than 1¼ inches in diameter.

32. Rain-water leaders must never be used as soil, waste, or vent-pipes; nor shall any soil, waste, or vent-pipe be used as a leader.

33. When within the house, the leader must be of cast iron, with leaded joints; when outside of the house and connected with the house-drain, it must be trapped beneath the ground or just inside of the wall, the trap being arranged in either case so as to prevent freezing. In every case where a leader opens near a window or a light-shaft, it must be properly trapped at its base.

34. No steam-exhaust or blow-off pipe from a steam-boiler will be allowed to connect with any soil or waste pipe, or directly with the house-drain. They should discharge into a tank or condenser the waste from which, if to be discharged into the sewer through the house-drain, must be connected on the sewer side of the running trap.

35. Subsoil drains must be provided whenever necessary.

36. Yards and areas should always be properly graded, cemented, flagged, or well paved, and properly drained; when the drain is connected with the house-drain, it must be effectively trapped. Front-area drains must, where practicable, be connected with the house-drain inside of the running trap.

37. Cellar and foundation walls must, where possible, be rendered impervious to dampness, and the use of asphaltum or coal-tar pitch in addition to hydraulic cement is recommended for that purpose.

38. No privy-vault or school-sink will be allowed in any cellar or basement; nor shall the general privy accommodation of a tenement or lodging house be allowed to be in the cellar or basement.

39. School-sinks must be of cast iron, not more than two feet in depth, connected at the upper end with the water-supply, and at the lower end with a drain leading to the street-sewer, and provided with an outlet at the lowest point and on the bottom so as to admit of a complete discharge of the contents whenever the outlet is opened and the sink flushed with water.

40. When a privy-vault or cesspool must necessarily be used, and the water-supply of the premises is from a well, they must be at least fifty feet from the well; and the privy-vault must be absolutely tight.

41. Pan-closets are strictly prohibited.

SUGGESTIONS.

[SECTION 10. The location of mouth of fresh-air inlet should be decided by local circumstances, and not the same in all cases.

SEC. 12. A vertical soil-pipe should extend through roof, even if it only receives the discharge of one fixture.

SEC. 18. It is a mistake to put stop-cocks at foot of a soil-pipe or waste-pipes. They are only an obstruction, a needless expense, and liable to cause trouble, and not at all necessary for any testing purpose.

SEC. 26. The method for connecting vents to traps does not prescribe good practice. Where lead traps are used a soldering-union would make an obstruction on the inside of the trap. They may be used on an iron trap because there is a boss of sufficient thickness to take the threads of the nipple, but on the ordinary lead traps the vent should be soldered as indicated by "J. T.," in his communication on page 140, issue of January 8.

Though we make the above suggestions, we congratulate the citizens of Rochester on the progress made in securing the adoption of these regulations. We trust ample provision will be made for their enforcement, so that the benefits to be derived may be fully realized.—ED.]

DIFFICULTY WITH A KITCHEN BOILER CIRCULATION.

BOSTON, January 17, 1887.

SIR: The cause of Mr. J. S. Johnstone's trouble with his hot-water pipes seems to me to be simply the lack of opportunity for any circulation. If the pipe taken from head of boiler were carried directly to the bath-cock, and connected with a return to the lower part of boiler, the hot water ought to circulate freely in the direction shown by my sketch. In any case a relief-pipe ought to be taken from top of the hot-water pipe and carried to above the supply-tank. Am I right? B.

[There is no doubt what our correspondent (B) suggests will improve J. S. Johnstone's apparatus, (issue of January 15). In our reply we assumed the pipes were carried below the floor and boiler, because they could not be carried overhead, the broken lines indicating that the bath-tub was at some distance, and hence we did not conclude it was necessary to advise him to alter the whole plan of his apparatus. A circulation also will help to keep the water in the boiler below the steam-making point of temperature.]

SPACE REQUIRED FOR STORAGE OF GAS.

WHEELING, W. VA., December 12, 1886.

SIR: Will you kindly inform me how many cubic feet of space it will require to store 25, 50, 75, and 100 pounds respectively of coal-gas or natural-gas, and how long it will take to empty said spaces, at ¼-pound pressure (being regulated by pressure-regulator), through six ⅛-inch round openings? The reason for troubling you is, I cannot find any book with any rules for such questions. A private answer on above will kindly oblige, Yours, etc.,

G. W. L.

[If the specific gravity of the gas (air=1) is multiplied by 0.0768—the weight of one cubic foot of air in pounds—the product will give the weight of a cubic foot of the gas. From this, the volume of any given weight of the gas can be readily calculated. The time required to pass any given volume of gas through a given opening can be calculated from the following formula, in which

Q=Quantity of gas passing per hour, in cubic feet.

l=length of pipe, in yards.

d=diameter of pipe, in inches.

h=pressure, in inches of water.

s=specific gravity of gas (air=1).

$$Q=1350\, d^2 \sqrt{\frac{h\ d}{s\,(l+d)}}$$

THE Cohoes, N. Y., Master Plumbers have elected the following officers: President, H. E. Bottum; Vice-President, E. V. Cady; Secretary, W. H. Long; Treasurer, Robert Campbell; Trustees, John McGuire, W. B. Clark, and Charles P. Craig.

THE Philadelphia Association of Master Plumbers, at their last meeting, elected the following officers for the year: President, Wm. W. Mentzinger; Vice-Presidents, Albert M. Hicks, Wm. M. Wright, Alex. G. Bond, John J. Weaver, Samuel W. Norris; Recording Secretary, Enoch Remick; Corresponding Secretary, Wm. S. Clark; Treasurer, Wm. Harkness, Jr.; Sergeant-at-Arms, Samuel B. Fleming; Board of Directors, Wm. W. Mentzinger, John E. Eyanson, Albert M. Hicks, John J. Weaver, Enoch Remick, and John A. Heffron. The trade schools of the association will resume the sessions February 1.

THE cost of street-cleaning in Milwaukee in 1886 was $44,000. All the work is done by the day, no contracts being made. The claim is made in Milwaukee that the streets of the city are cleaner than those of any city in the world having a population of 175,000.

THE Michigan State Board of Health has appointed a committee to prepare plans, with the assistance of a skilled architect, for a model school-house, with heating and ventilation.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

ODORLESS FUEL-GAS KILLS THREE PEOPLE IN TROY.

(Special Correspondence.)

TROY, N. Y., January 19, 1887.

SIR: Last week THE SANITARY ENGINEER AND CONSTRUCTION RECORD published an account of the narrow escape of twelve people in this city from death by fuel-gas which had found its way into stores from a break in the gas-mains. That account is here to be supplemented by a more disastrous occurrence from the same cause.

On Sunday night, January 16, three people were killed by this gas, and three or four others escaped death only by timely rescue. The stores in which the former prostrations took place are perhaps three hundred yards from the works of the Troy Fuel-Gas Company. The disaster of the 16th occurred within thirty yards of the works and on the same side of the street. The fact that a break in the main had taken place was discovered by the sudden illness of some inmates of a boarding-house. They were taken with dizziness and aching throughout their systems, with faintness, and nausea. This occurred about 9:30 in the evening. There were eleven persons in the family. When the physician arrived one of the sufferers could only gasp, "I guess I am dying." Fresh air was admitted by the windows, restoratives administered, and the patients recovered. The cause of their illness was at once decided to be the inhaling of fuel-gas. The man in charge of the works, only a few doors away, was informed of what had taken place, and he, with an officer, roused other people near by, rapping them up and inquiring if any were ill. The gas was meantime shut off from the main.

In prosecuting this search the officers were obliged to force their way into the second story of a building that stood only two or three doors from the gas-works. They saw a light burning through the windows, but could get no response to their rapping. They entered by a back stairs, and on going into the kitchen they discovered a woman well advanced in years sitting by the kitchen stove, in which there was no fire, her head dropped on one side as if she had fallen asleep. Going to her they found her dead. They then went into an adjoining room where there was a bright fire in the coal-stove, and a lamp burning. There, lying on the floor, they discovered a young woman dead, with a tin bucket near her that bore evidence that the dead woman had vomited. The woman's clothes were disarranged as if she had struggled to free herself from a destroyer. They sought for other victims, and on a lounge discovered a dead man sitting upright, as if he had fallen asleep. His hands were locked together on his lap. The man showed no signs of having suffered from either pain or nausea. The other victim proved to be Mrs. Caroline Bennett. She was seated in an armchair by the kitchen-stove, and held her false teeth in her hand. She was dressed, and had died, apparently, without pain, for there were no evidences of a struggle.

One of the persons who was saved by timely aid gives his experience. He says that about seven o'clock in the evening he was sitting in his store when he began to feel sick. Unlike some of the victims who have been prostrated by this gas here, he says he was uncomfortably warm after the attack, but that he had a great pain in his head.

Living over the store, he went upstairs to his room at about nine o'clock and went to bed. About half-past eleven he was roused by the barking of his dog. Feeling still very sick, but being able to get up, he went downstairs, and in doing so he met a woman who lived in part of the building and who told him her husband had been taken so seriously ill she thought he was dying. The man started for a physician for this woman's husband, but on reaching the walk he fell headlong and was unable to help himself further. The dog was also affected as the human beings were. Before fresh-air was admitted to it, it tumbled over and cried with pain, its limbs became stiff, and when rescued it was lying in a stupor. Another victim relates a pleasant experience as he was going off into unconsciousness. He went to bed early and fell to sleep. Afterwards he roused up and then he seemed to be dreaming. He thought he was on board of a boat that lay in the Hudson River at the gas-works. The boat changed into a fuel-gas works, and he was criticising the process of making the gas, his monitor being Prof. Lowe, the designer of the fuel-gas plant that was pouring the deadly gas into these neighboring buildings. This gentleman says the sensations he had were so extremely soothing and pleasant that if he had been left alone he would have died a painless death. One lady who was restored when nearly beyond help, says her extremities were numb. At times her fingers felt as if they were off from her hand, and again they felt as if they were frozen stiff. The gas seems to have affected different persons differently.

As soon as these sick and dead people were found the gas was shut off at the works, and it has not been again turned on. The Superintendent, George S. Geer, said to the writer to-day that the fires were drawn from the works as soon as possible after the disaster was made known to him, and that no more gas would be made until the subject of its safe distribution shall have been thoroughly investigated. The calamity spread alarm throughout the city wherever the mains were. People who are using the gas refuse to have anything more to do with it. They cannot use it if they want to, for the works are closed. Mr. Geer says the break has not been searched for because no more gas will go into the mains. The break is known to be, however, in a wrought-iron main near the works. The lengths of pipe are secured tight, as they were put down by the old Steam-Heating Company, whose plant the gas company has been using. The Superintendent's theory is that the pipes by shrinking during the cold weather have drawn apart, there being no leeway allowed for contraction and expansion. Escaping from the break in for pipe the gas followed the the weakest resistance through the gravel, and on reaching the cellars it passed up through the buildings. The severest cases of prostration occurred on the second and third floors, the three dead people having met their doom on a second floor.

The city authorities have taken up the matter, and it is probable the gas company will not be allowed to go on with their business, even if they are not themselves convinced that it would be worse than folly to attempt further distribution of their product. Superintendent Geer makes no secret of his chagrin, nor does he question the theory that the death of the three persons and the wretched sickness of the others were caused by gas from his mains. He says that before beginning the manufacture of this fuel-gas here the natural-gas plants of Pittsburg and other places were examined, and that the Troy plant was laid as near as possible like those natural-gas plants. The Troy company is controlled by stockholders in Philadelphia. A meeting has been called of the persons interested to see what can be done to render the distribution safe. They have tried the experiment of odorizing the gas with carbolic acid, but besides being insufficient the cost of this odorizer renders its use impracticable. If naphtha is used, Superintendent Geer says the gas becomes ordinary illuminating water-gas, too expensive for the use to which the plain fuel-gas is sought to be put. The shutting down of these works is financially serious to both the company and the consumers, the latter being largely laundry-men, who are obliged to return to either luminous gas or put in hard-fuel apparatus. The company has a 200,000-foot holder nearly ready for use. Whether it will be completed and the manufacture of the gas continued will depend on the guarantee of safety which the company can devise.

THE RAILROAD AND ENGINEERING JOURNAL.

WE have received the first number of this journal under its present title—really, however, as is explained in its pages, the first number of the fifty-fifth volume of its progenitor, the *American Railroad Journal.*

As consolidation is the order of the day in railroad matters, it is fitting that under the energetic management of our old friend, Mr. M. N. Forney, the journal just named and Van Nostrand's *Engineering Magazine* should be joined, that under a new name and by concentration of effort it may achieve a still wider circulation and increased usefulness.

It is evident, from an inspection of the pages of the first issue, that it is not the intent of the editor to narrow the range of subjects treated, but exercise a wise eclecticism and strive for the best in all things.

It comes to us in a very attractive dress, in good type, well printed, and of a very convenient size for reading.

It is to be issued as a monthly, and we heartily welcome it, both for its subject matter and because of personal esteem for its editor.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
January 15..	24 46	19 38	20.63	30.35	29.94	22.19	30.29

E. G. LOVE, Ph.D., *Gas Examiner.*

AN explosion of gas in the engine-room of the Batavia, N. Y., clamp factory, on Tuesday morning caused a fire which destroyed several blocks of buildings.

THE Boston and Albany Railroad made a test of lighting cars with incandescent electric-lamps a few days ago. Storage-batteries supplied the electricity. The test is reported to have been satisfactory.

IOWA ARCHITECTS.

THE Iowa State Association of Architects met in Des Moines January 13, Secretary C. H. Lee calling the convention to order. Reports from committees were received, among them from the committee appointed to draft a bill to govern the construction of party-walls.

The Committee on Statutory Laws presented the bill prepared by the Committee of the Western Association of Architects, which committee consists of one member from each of twenty States represented in the Western Association. It is proposed to bring the bill before the various State Legislatures for action, looking to the regulation of the practice of architecture.

The Committee on the Conduct of Contractors, to which was referred the August resolution, reported by Hammatt, recommending its adoption. This led to a lively debate participated in by several members, and finally resulted in the adoption of the following resolution:

"*Resolved*, That it is the sense of this association that any contractor who regularly employs a draghtsman and furnishes architectural plans shall be debarred the privilege of figuring on work in the offices of any member of this association."

A report of the Committee on Preparing a Code of Competition was read and amended, and ordered printed.

Mr. F. D. Hyde, of Dubuque, delivered a eulogy on the life and works of the late W. W. Sanborn, of Clinton. It was ordered that the eulogy be printed, and a copy sent to the family of the deceased.

Officers were elected as follows: President, Eugene H. Taylor; Vice-President, G. G. Baldwin, Sioux City; Secretary, F. D. Hyde, Dubuque; Treasurer, E. S. Hammatt, of Davenport; additional member of the Board of Management, C. H. Lee, Des Moines.

After passing a vote of thanks to the Des Moines association the convention adjourned to meet at Spirit Lake on the second Wednesday in August, 1887.

ARCHITECTS AND STATE MEDICINE.*

DR. OSCAR C. DE WOLF began his paper by saying that he proposed to discuss certain relations of State Medicine to the profession of architecture. He defined State medicine to be "the legal regulation of the conduct of individuals toward each other in strictly sanitary matters." Without the aid of State medicine the architect will construct his house in vain. He may provide for all possible phenomena, but without such re-enforcement he may perhaps as well practically conclude, with the New York architect quoted the other day in the New York *Post*, that the best plumbed house is the house with no plumbing at all. State medicine includes not only quarantine, abating nuisances, and the like, but also a rapidly increasing volume of legislation concerning the construction of buildings, with reference to security from fire, lighting, drainage, and ventilation. A recent text book on hygiene stated that architects had not yet kept pace with sanitarians in house construction. A Scotch author says that the sanitary arrangement of houses is the least attractive particular of building to the average architect, and that the architects especially who care much about drainage are very few. The speaker knew that in the West, very largely among architects, there is artistic and practical merit and that sincerity which Emerson commended when he said that "he builded better than he knew." The architect who in Howells' story of Silas Lapham is given a *carte blanche* has no trouble in making a house sanitary. When the public will pay the bill, the architect in this respect will not be found wanting. Fully half of the total mortality of the country is properly credited to preventable diseases, though not all are preventable by any obtainable construction of a building. Yet the safety, the healthfulness of a dwelling depends on its architectural structure. Before the discovery of that immortal man, Jenner, had thrown its protection over the world, almost every house in Great Britain was periodically subject to small-pox. It could not be said how long this disease and others infested the woodwork and other interior surfaces of living-rooms. Referring to statistics on diseases of the chest among British soldiers, the speaker showed the demonstrated ravages from overcrowding, insufficient ventilation, and uncared for sewage. Then came radical overhaulings of barracks, with the result that instead of being the foci of consumption and divers diseases, a conspicuous freedom in that regard had been secured. In jails typhoid fever was long the peculiar scourge, and now by similar means this is changed. Well might Dr. Richardson say that errors in sanitation are not sufficiently eradicated from elegantly built houses. This room has no fire-place; that is too small; in the other the window opens with difficulty—such and like mistakes in domestic architecture are the vestibule to the grave. Seven points constitute the charter of health in a house: It must present no facilities for holding the poisonous particles of disease. It must possess every facility for the removal of its impurities as fast as produced. It must be free from damp. It must be well filled with daylight. It must have a supply of pure air, and that steady without currents. It must have an even temperature. It must have an abundant supply of pure water. And by the agency of State medicine, reenforcing the architects, this may all be done in cities. With the support of the Illinois State Association of Architects, legislation has taken place in this State under whose action a great saving of life is steadily going on in Chicago. From a death-rate of 26 per thousand in 1878, the mortality is now reduced down to 18—a saving of 6 lives per thousand per annum; which means that there are now living 4,500 people, residents of this city, who would have died during the past year had the death-rate of 1878 been maintained. How has it been reduced? I claim it has been reduced by tenement-house inspection very largely and to an enforced observance, more and more, of the higher architecture. The noble profession represented before him were the architects not only of their own fortunes, but pre-eminently of those of others. To the architect are we all indebted for healthy life.

*Abstract of a paper read by Dr. Oscar C. De Wolf, of Chicago, at the meeting of the Western Association of Architects in Chicago, November 18, 1886.

THE eighth annual report of the State Board of Health of Illinois contains a brief summary report from the Board, a record of its proceedings at its quarterly meetings, with a summary of office work, and the text of some legal proceedings and judicial rulings under the Medical Practice Act, the whole occupying 130 pages. Following this comes an appendix of 556 pages, containing the following papers—viz.: A, Report on disinfection, being a summary of the report of the committee of the American Public Health Association on that subject; B, The report of the Secretary, Dr. Rauch, on the results of an inspection made by him of the quarantines maintained upon the Atlantic and Gulf Coasts from the St. Lawrence to the Rio Grande; C, Report of the proceedings of the seventh annual meeting of the Sanitary Council of the Mississippi Valley; D, A series of meteorological tables; E, A report on the State Sanitary Survey; F, Vital Statistics; G, Medical Education in the United States and Canada.

Of these various appended papers the most interesting to sanitarians and engineers is that which relates to the results obtained by the State Sanitary Survey, in which an attempt was made to secure a systematic inspection of every dwelling-house in the State. A part of the results are given in the following summary which relates to 395 of the smaller towns and cities.

Total number of houses and premises inspected 222,385. Of these the site is reported "good" for 139,830, "fair" for 76,628, "bad" for 5,923, and "sewered" for 8,295.

Of the houses, 115,928 were built of wood, 50,463 of brick, 51,679 of wood and brick, and 4,315 of other materials; 122,056 are reported as having dry basements or cellars, 39,894 as having damp ones; 118,892 had privies reported as "good," 50,955 as "fair," 50,563 as "bad," and 1,580 privies as having sewer-connections; 5,925 had good water-closets, and 396 bad ones. The water-supply was, from hydrants 15,010, from cisterns 151,285, and from wells 165,119. Of the cisterns 5,135 and of the wells 5,535 are characterized as "bad."

These buildings were occupied by 1,025,702 persons, of which 425,834 were children. Of these children 96,125 were found to be not vaccinated.

As there was very thorough vaccination of all children of school age throughout the State in 1883, these last figures indicate the rapidity with which non-vaccinated children accumulate, and furnish material for the epidemic spread of small-pox.

Like its predecessors, this report, with its appended documents, is an interesting and valuable addition to sanitary literature, and it is to be hoped that it will be widely distributed.

THE brief report of the Board of Health, which prefaces the sixth annual report of the State Board of Health of New York for the year 1885, refers to the increased activity of local boards throughout the State, and the correspondingly increased demands upon the central board for advice and information, and points out the most economical way in which the State can supply to each locality the benefit of the best expert advice in sanitary matters is by keeping up a force of skilled sanitary inspectors, engineers, and chemists under the direction of the State Board. The State system of registration of vital statistics is not complete, but it is estimated that about nine-tenths of the deaths which occur are registered. There are 20 cities, 347 villages, and 944 towns in the State, which by law should have boards of health and report vital statistics to the State Board. All of the cities, most of the villages, and about 700 of the towns make such returns.

The population of the State is estimated at 5,400,000, and the number of deaths during the year at 100,000, or a little over 18 per 1,000. The number of deaths actually reported and accounted for is about 88,000. The ratio of deaths from zymotic disease was 222.17 per 1,000 of deaths from all causes. Upon the whole, it was a healthy year. Among the reports and papers appended to the report of the board there are, as usual, a number of interest and importance. One of these is a sort of digest of the sanitary laws of Great Britain and of the several States of this country, with references to certain judicial decisions on disputed points connected with the rights and duties of boards of health, prepared by Hugh Weightman. While this is by no means a complete summary as regard the United States, and some of the most important judicial decisions are not referred to, it is nevertheless a useful compend.

The report of the committee on drainage, sewerage, and topography occupies nearly one-third of the volume, and includes accounts of investigations made in, and the recommendations for drainage and sewerage of various localities, the most important being those relating to the drainage of the abandoned canal in the vicinity of Rome, with maps; to the Elmira Reformatory sewerage, with specifications for construction; to the drainage of a swamp in the town of Westchester; to the sewerage of Warsaw and of Mt. Vernon, and to the pollution of the water-supply of Binghamton by sewage. A brief report by Horace Andrews, Jr., on the practical operation of the separate system of sewers contains the experience gained at Keene, N. H., and at New Brighton and Rockaway, N. Y., the conclusions being on the whole favorable to the system. Mr. Andrews remarks that, "the results at New Brighton indicate that the principal difficulties to be met with are those of administration. In small places, where it is difficult to obtain constant inspection by persons thoroughly acquainted with those essentials necessary for the perfect working of the system, trouble may be expected from careless supervision and from bad workmanship in making house-connections."

The reports of the analysts under the food, drug, and beer laws show that some work has been done in investigating the amount and character of adulterations prevalent.

As regards vinegar, it is reported that the addition of mineral acids is very uncommon, but that watering is largely practiced. The report by Frederic Carman on beer, containing the results of an extensive series of analyses by Dr. Engelhardt, is a document of permanent value. Dr. D. F. Lincoln's report upon school hygiene is a good educational document.

Taken as whole the report is one to be commended, and upon which the board is to be congratulated. It shows that the board is actually doing something besides writing vague circulars about the dangers of filth, and that the manner in which it has used the money appropriated for it is a good reason for giving it more.

EPIDEMIC of bowel complaints at Grand Rapids, Mich., is attributed by the physicians to the pollution of the water by filth in the canal.

THE Master Builders' Association of Boston held a banquet last week. Steps are being taken for the organization of a National Master Builders' Association, and a convention will be held in Chicago, March 29.

THE New York City Board of Health has been requested, by a numerously signed petition, to appoint six women inspectors on the tenement-house corps.

PERSONAL.

JAMES WEBB, for sixty years a contractor in this city, died last Friday in the eighty-seventh year of his age.

GENERAL W. B. HAZEN, Chief Signal Officer, U. S. A., died in Washington, January 16. General Hazen was in his fifty-seventh year. His record in the army during the Rebellion was that of a most determined and daring fighting officer.

JOHN LEONARD, mechanical engineer, formerly intimately connected with the introduction of steam on the lakes, died at Denver last week.

NAVAL CONSTRUCTOR THOMAS E. WEBB has been assigned to duty at Cramp's Shipyard, Philadelphia, to superintend the construction of the new cruiser to be built by that firm.

CONGRESSMAN BRECKENRIDGE, of Kentucky, has offered a resolution in the House of Representatives instructing the Secretary of the Treasury to investigate the best means of constructing and heating railroad-cars and steamboats, so as to diminish danger of fire. He is to communicate with inventors and others, receive drawings and descriptions, and lay the result of his inquiry before Congress.

Patents.

353,703. Water-Meter With Revolving Non-Rotating Piston, Lewis H. Nash, Brooklyn, assignor to the National Meter Company, New York, N. Y. Filed March 23, 1886. Issued December 7, 1886.

353,704. Method of Commingling Flowing Fluids in Definite Proportions. Lewis H. Nash, Brooklyn, assignor to the National Meter Company, New York, N. Y. Filed September 23, 1885. Renewed October 7, 1886. Issued December 7, 1886.

353,705. Device for Commingling Flowing Fluids in Definite Proportions. Lewis H. Nash, Brooklyn, assignor to the National Meter Company, New York, N. Y. Filed September 23, 1885. Renewed October 7, 1886. Issued December 7, 1886.

353,735. Window-Shutter. Lewis G. Comparet, Des Moines, Iowa. Filed June 11, 1886. Issued December 7, 1886.

353,739. Hydrant and Fire-Plug. Henry E. Earle, Danbury, Conn. Filed March 18, 1886. Issued December 7, 1886.

353,747. Regenerative Hot-Blast Stove. John M. Hartmann, Philadelphia, Pa. Filed November 17, 1884. Issued December 7, 1886.

353,802. Stop-Cock. Charles J. Mortimer, New York, N. Y. Filed March 17, 1886. Issued December 7, 1886.

353,805. Register-Connection for Piston Meters. Lewis H. Nash, Brooklyn, assignor to the National Meter Company, New York, N. Y. Filed December 29, 1883. Issued December 7, 1886.

353,806. Oscillating Water-Meter. Lewis H. Nash, Brooklyn assignor to the National Meter Company, New York, N. Y. Filed September 22, 1885. Issued December 7, 1886.

353,839. Heating Apparatus for Railway-Cars. William C. Baker, New York, N. Y., assignor to the Baker Heater Company, same place. Filed April 18, 1885. Issued December 7, 1886.

353,843. Air-Mixer for Gas. James L. Brown, Brookville, Pa. Filed February 18, 1886. Issued December 7, 1886.

353,844. Pull for Water-Closet Cisterns, etc. William Burrows, Brooklyn, N. Y. Filed September 24, 1886. Issued December 7, 1886.

353,882. Automatic Water-Feeder for Steam-Boilers. Charles O. Rabut, New York, N. Y. Filed August 4, 1886. Issued December 7, 1886.

353,888. Sewer-Pipe Back-Pressure Valve. William H. Simpkins, St. Louis, Mo. Filed August 23, 1886. Issued December 7, 1886.

353,900. Loop-Pipe for Radiators. George W. Walker, Malden, Mass. Filed March 31, 1885. Issued December 7, 1886.

353,981. Covering for Pipes, Boilers, etc. Herbert M. Small, Baldwinsville, Mass. Filed April 30, 1886. Issued December 7, 1886.

353,996. Steam-Generator. James Walp, Lehighton, Pa. Filed April 14, 1886. Issued December 7, 1886.

354,000. Flush-Tank. Joseph Wilson, Philadelphia, Pa. Filed May 10, 1886. Issued December 7, 1886.

354,016. Boiler-Cleaner. Isham T. Hardy, St. Louis, Mo. Filed September 23, 1885. Issued December 7, 1886.

354,017. Gas-Regulator. J. Henry Helm, Allegheny, Pa. Filed September 25, 1886. Issued December 7, 1886.

354,020. Valve for Hydraulic Elevators. Parker F. Morey, Portland, Oreg. Filed September 9, 1886. Issued December 7, 1886.

354,021. Self-Acting Gas-Cock. George Nobes, Harrow Road, County of Middlesex, England. Filed August 21, 1886. Issued December 7, 1886. Patented in England May 21, 1884, No. 8,030.

354,057. Boiler-Furnace. John Ham, Brooklyn, N. Y., assignor to the Ham Coal Saving Company, New York, N. Y. Filed April 15, 1886. Issued December 7, 1886.

354,067. Apparatus for Mixing Air and Gas and Delivering the Mixture to Carburetors. Robert S. Lawrence, Washington, D. C. Filed December 30, 1885. Issued December 7, 1886.

354,070. Hydraulic Elevator. Norton P. Otis, Yonkers, N. Y. Filed June 23, 1886. Issued December 7, 1886.

354,075 Waste-Pipe Trap. George Veale, Jr., Philadelphia, Pa. Filed September 13, 1886. Issued December 7, 1886.

354,078. Boiler-Feed Regulator. Charles O. Wyman, Anoka, Minn. Filed March 29, 1886. Issued December 7, 1886.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 9. — PUBLISHED EVERY SATURDAY.

NEW YORK, JANUARY 29, 1887.
LONDON, FEBRUARY 12, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. — IN AMERICA
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. — IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

IMPURE ICE.

ONE of the best illustrations of the progress of civilization in recent years is found in the change which has taken place with regard to the use of ice.

What was formerly the luxury of the few has now become almost a necessity for the many; the preservation and transportation of ice, or its manufacture by artificial means, and its regular delivery during the warm months, has become an important business, giving employment to a large number of men and requiring a large amount of invested capital.

This extended use of ice is especially an American custom. Fifteen years ago ice was not to be had at the smaller hotels in Europe, and at the best ones it was a special luxury, well charged for. Now it can be had without extra charge at almost every hotel, large or small, though it is by no means used in the profusion in which it is to be found here.

Questions as to the dangers to health connected with the use of ice taken from certain localities are therefore of great interest, the more so since disease produced by the use of contaminated ice could rarely be traced to its true cause, which in most cases would probably not be even suspected. Attention was in fact not called to this matter until 1875, when an epidemic of diarrhœa at Rye Beach, N. H., was clearly traced to ice cut from a contaminated pond.

Since that time the same cause has been suspected or proved in about half-a-dozen cases of occurrence of typhoid fever or of diarrhœa. Certainly this is a very small proportion of bad results as compared with the almost universal use of ice, especially when we remember that people will cut ice from streams or ponds that they would consider too impure to furnish drinking-water, because they think that freezing purifies the water.

While purification of water by freezing does occur to a considerable extent it is by no means complete or to be relied on. Freezing does not destroy the vitality of some bacteria, nor does it specially tend to free the water from dead organic matter. That freezing will not destroy the life of the bacillus of typhoid fever is shown by Dr Billings in a communication which is given in another column of this journal.

It will be seen from what has been said that when a health authority is called on to decide whether the water of a particular stream or pond is or is not so impure that ice cut from it will probably be dangerous to health, it can only proceed on probabilities, since it will very rarely be possible to prove that ice taken from that particular locality, or even the water from the same place, has caused disease. Nevertheless these probabilities may be quite sufficient to warrant the forbidding the sale of ice taken from a particular spot. This seems to have been the case as regards ice cut from Onondaga Lake which the City Board of Health of Syracuse, in this State, forbade to be sold for any use which would bring it into direct contact with articles of food or drink.

The firm engaged in packing and selling this ice objected to this interference with their business, whereupon Mr. James T. Gardner investigated the matter for the State Board of Health, which has published his report.

Mr. Gardner found that Onondaga Lake is contaminated with sewage, that the contamination is increasing from the sewers of Syracuse, and that ice taken from it contains living bacteria of various kinds, and about ten per cent. of the sewage matters in the water from which it is formed. He, therefore, approves the order of the City Board of Health, and the propriety and wisdom of this decision can hardly be questioned.

WARMING OF RAILROAD-CARS SO AS TO PREVENT CONFLAGRATION.

AFTER a disaster such as took place at Tiffin, Ohio, not long since on the Baltimore and Ohio Railroad, in which the living and the dead were burned to ashes by the taking fire of the coaches from the heating stoves, there is always severe censure and criticism from the press and general popular denunciation from the public. This lasts, however, only a short time. The victims are buried. The railroad companies settle with the few who are inclined to demand damages, and the public forget for the time being their danger.

During the time of popular clamor, however, every one who is interested in a device for warming cars comes to the front with the hope of attracting attention to himself and his apparatus. Inventor-like, each thinks his own the best and only apparatus to be used, and they besiege the offices of the superintendent of the railway companies and bother every one they can approach with the merits of their own device and the defects of all others. This gives the railroad manager who does not intend to lay out one dollar for such matters the chance he is glad to avail himself of—viz., to cry "crank," etc.—and it produces a confusion of ideas on the part of the partially informed manager who might (?) adopt something, provided he was convinced it was practicable.

The New York *Tribune* lately reports an interview with Mr. Chauncey Depew, President, of the New York Central Railroad, in which he says:

"We are constantly making experiments to find some plan by which we can warm cars comfortably and at the same time prevent or lessen materially the possibilities of setting fire to a wrecked car in case of a smash-up. It is an extremely important question and one on which all railroad managers are alert. I suppose there have been five thousand devices to reach this end. But there isn't one which is practicable. On some lines the stoves are placed under the cars, but in a trip I made with William H. Vanderbilt at one time—one of the last trips he made, by the way—we were in a coach heated from beneath the floor. Why, we almost froze. Now suppose in such a car as that you run into a snow drift, how are you going to get at the stove? And then they build ramparts around the stoves. But these are no protection, for they won't withstand the shock of a collision, and the live coals will scatter from such a stove as quickly as from another. Everything like that in a collision is wrenched to pieces."

When asked what of the possibilities of using steam, he replied:

"No engine pulling a train of fourteen to seventeen cars, some of them Wagner coaches, each of which is much heavier than an ordinary passenger car, can supply steam enough for the motive power and for heating, too. That is the serious obstacle against warming the coaches as the elevated road does. Besides, we make up trains here at Forty-Second Street, and before the train goes out of the station the engine may be blocks off. It is not always possible to have an engine attached to a waiting car or a train simply to give heat. And another objection to steam is that after a train has left New York for example, it will pick up additional cars at Poughkeepsie, Albany, Utica, Syracuse, and so on. These cars have been waiting at these stations in advance of the coming of the train to accommodate passengers and save time. Often they are sleepers in which persons have gone to bed early. They must be kept warm, and how is that warmth to be had from an engine drawing a train miles away? It has been proposed to have a

special boiler attached to the baggage-car with a special attendant. This would give heat to the complete train, but I don't know that the plan has ever been put into any kind of successful operation. What must be devised is a source of heat for each car without the use of fire. There will be money for the man who will put that idea into practice. We are willing to examine everything that has any elements of value. Our superintendent of motive power has studied the problem assiduously and has suggested the best improvements which have been made so far."

From the above, therefore, there can be no doubt Mr. Depew fully appreciates the gravity of the question and the importance and necessity of doing away with *a fire within a car*. We regret, however, that he is not better informed as to the amount of steam necessary to warm a car, and on the methods already in use and which have proved fairly successful—indeed, so much so that it seems only to require the co-operation of the railway managers to demonstrate their practicability and make their use general. President Depew is not, of course, an expert in mechanical details, and, therefore, has to depend on the advice of those under him in such matters. He knows, however, that the limit of capacity or size of a locomotive has not yet been reached, and that as trains became heavier in the past locomotives were increased in size, etc., to keep pace with the improvement. This will be done in the future as well, but at the present time all of the passenger engines make steam easily enough to be able to spare steam to warm a train, as *the power necessary to draw a single car will warm a whole train.* We know he overestimates the amount of steam required for the warming of a train of cars, and we speak advisedly when we say that the steam necessary to draw a single passenger-coach forty-five miles an hour is more than enough to warm the largest passenger train on his railroad.

Two hundred square feet of pipe-surface is more than sufficient to warm a coach or sleeping-car. The condensation per square foot of heating-surface will never exceed one-half pound of water per hour, even under the severest conditions, for direct radiation, known to us. One-third of a pound of water is considered a high average in house-heating. But, assuming we take the highest possible average condensation, we have but to condense *one hundred pounds weight* of steam per hour per car, and for seventeen cars 1,700 pounds *weight* of steam, or, in other words, 1,700 pounds of condensed water formed in an hour for a train. If we consider, then, forty pounds *weight* of steam per hour as a horse-power in a locomotive (a low average estimate for many of them), we have 1,700 lbs. ÷ 40 lbs. = 42.5 horse-power as that required for warming a train of seventeen cars—more than an average train even for the N. Y. C. & H. R. R.

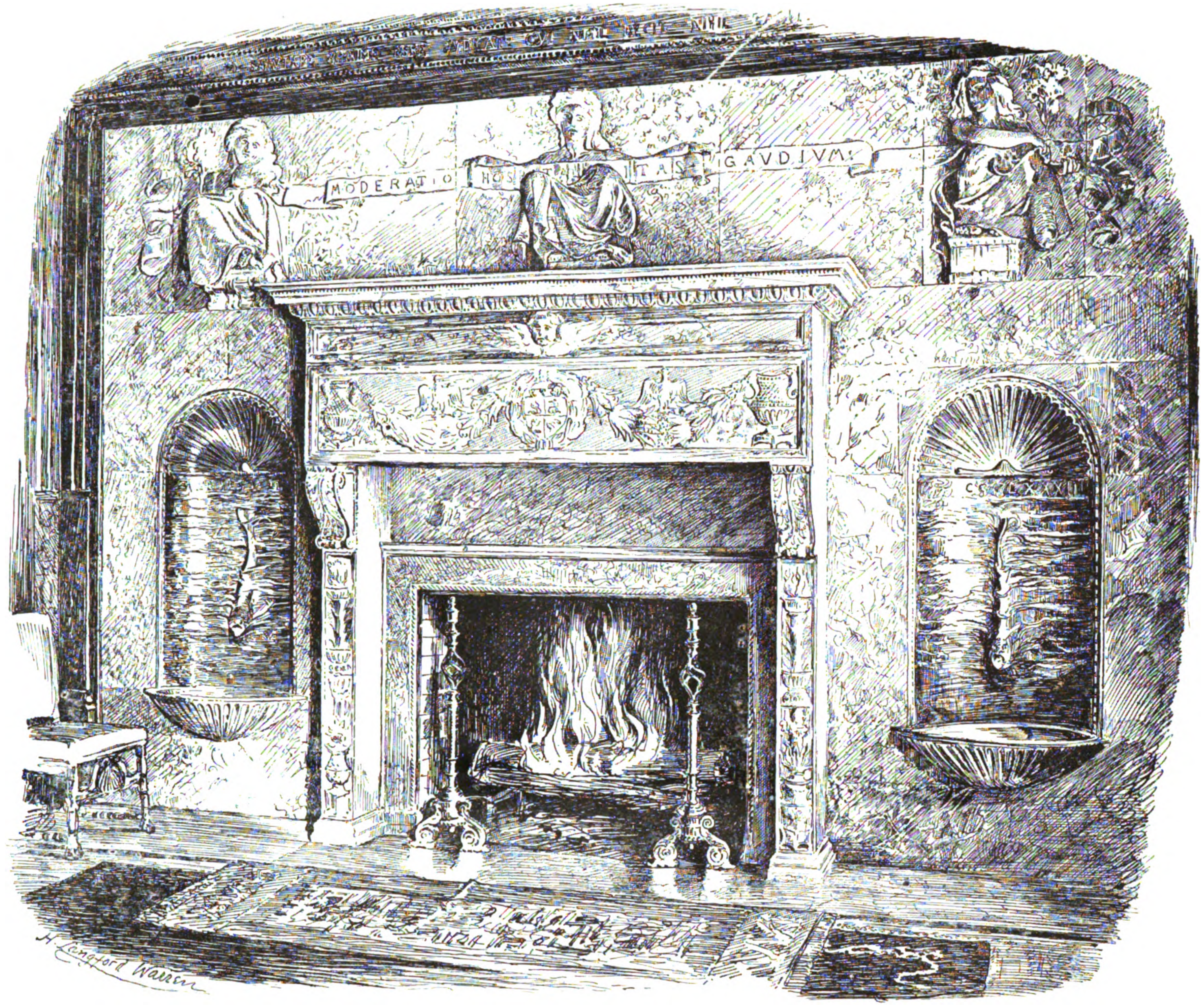
If we now consider the horse-power of a passenger locomotive with 17″ × 24″ cylinders and 5′ 6″ driving-wheels, carrying about 140 pounds pressure of steam and running 60 miles an hour, we have $17^2 \times .7854 \times 70$ pounds mean pressure in cylinder × 1,220 feet piston-speed × 2 cylinders ÷ 33,000 = (the enormous duty of) 1,175 horse-power. Let us assume, however, that only half this horse-power is developed (so we will be on the safe side in the calculation), as the point of cut-off may be shorter and the average speed only 40 to 45 miles per hour. At 40 pounds of water, then, to the horse-power, when developing only 587.5 horse-power, the locomotive must evaporate 23,500 pounds of water into steam, and as only 1,700 pounds of this water is required for warming the train of 17 cars, or about 7 per cent. of all the steam is required for warming a train.

From this it will be seen that an increase of 10 per cent. in the size of engines will more than do for the warming of trains, even if they have to be increased ; but, as a matter of fact, any good modern engine will be able to spare much more steam than will be required. The real difficulty seems to be that the superintendents of motive power, who would like to introduce their own ideas on railroads, are hampered by the patents held by more enterprising inventors on their prior ideas. If the railroads could take the good points out of the contrivances mentioned by Mr. Depew, and not compensate the inventors, we would soon have cars warmed by the contrivances of superintendents and master mechanics, and it looks as though many railroad managers are only waiting until important patents run out that they may avoid their obligations to the inventors. This question is one that may well engage the attention of our State railway commissions as well as the national one just created by the passage of the Inter-State Commerce Act.

EPIDEMIC MEASLES.

MEASLES has been unusually prevalent in New York City during the past month, 641 new cases and 72 deaths having been reported as due to this cause in a single week. Its spread is mainly in the tenement-houses, where it is almost impossible to secure such isolation as will prevent the spread of the contagion. Moreover, as Dr. J. B. Taylor, of the Sanitary Bureau, has pointed out in a special report, many parents wish their children to have measles while they are yet young, and some will even deliberately expose their children to the contagion. Measles is a disease which spreads by contagion only, and the liability to it in unprotected persons does not lessen with advancing age, while it is if anything more dangerous in the adult than it is in the infant, owing to the liability to complications with bronchitis. In these last two respects it is very different from scarlet fever, and therefore measures to prevent its spread are of much less use and importance than they are for scarlet fever. The chief point in preventive medicine to be borne in mind with regard to measles in our present state of knowledge is that it is much more dangerous in cold or very changeable weather than it is during the warmer months, owing to the increased liability to pulmonary complications, and that therefore efforts to secure isolation and to prevent its spread through schools, etc., are much more useful in the winter than at any other time. It is quite probable that in the near future it will be considered best to purposely cause a very mild or attenuated form of measles in children during the summer months to protect them against future attacks, but we are not yet quite ready for this step. Until something of this sort can be done epidemic measles is sure to prevail at intervals of a few years, whenever a sufficient number of unprotected children have accumulated in the tenement-house and school-attending population and the spark of contagion is cast among them.

RESIDENCE AT PHILADELPHIA, PA.—JAMES H. WINDRIM, ARCHITECT.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

FIRE-PLACE IN DINING-ROOM OF THE VILLARD HOUSE.

McKIM, MEAD & WHITE, ARCHITECTS.

OUR BRITISH CORRESPONDENCE.

Electric Wires Disabled by Snow—Effects of Snow on the Tramways—Vienna Health Congress—A Trip through the Paris Sewers—An Underground Cable System—Sewage and River Pollution.

LONDON, January 12, 1887.

APART from the question of danger to life and limb, the disadvantages of overhead telegraph and telephone wires, from a business point of view, have been emphasized by the result of a recent snowstorm in London. With an average snowfall of about nine inches the result on the telegraph wires was to break both wires and posts. In the city, the clutches of wires are hanging in festoons in every street, while a great number of wires are fastened on to the lamp-posts to avoid danger from their flying in the wind. Telegraphic communication is entirely interrupted with the south, east, and west of England, and can only be carried on in a very limited degree with the north. The effect upon the train service by interrupted telegraphic communication has also been very serious, and the damage done, apart from the interruption to business, will reach several thousands of pounds. The dangerous nature of the present telegraphic system is best exemplified on the stretch of railway line from Fenchurch Street Station to the various down river docks. The line here is built on brick arches, and is on a level with the roofs of the houses of a quantity of small property which runs right up to the railway. About five out of every six of the telegraph posts are broken off like carrots, and, together with the wires attached, are either resting on the roofs of houses or swinging over the sides. The fall of the wires has in some cases done damage to chimneys. Several accidents are reported as the result of breaking wires, and also of the tearing down of the grid-irons, to which the telephone wires are attached on the roofs of the houses, from their places. Not a single wire is available at the Telephone Exchange.

The Highgate Steep Grade Cable Tramway Company may congratulate itself on having shown superiority over other tramway services in snowy weather. The general London tram service was all thrown out in the storm referred to above, but, by using a snow-plow, and not being dependent on horse-power, the cable tramway was enabled to work the usual service without interruption.

An International Health Congress is to be held in Vienna in the course of September next.

A most peculiar fete is reported from Paris in connection with the entertainments in aid of the funds for the relief of the sufferers from inundations in the south of France. This particular entertainment consisted of a trip in boats through the large Paris sewers from an entrance at the Madeleine to the Place Chatelet. Most people, when business does not lead them that way, are not inclined to go down the sewers for pleasure.

Apropos of the damage to overhead wires, there has during the past week been exhibited at the works of the Anglo-American Brush Electric-Light Corporation a system for carrying underground cables. A "way," otherwise a rectangular block, of three, six, or twelve feet in length, constructed of bitumen concrete, is pierced with channels to carry the said cables. The blocks are constructed to fit end to end and with a saddle closing over the joint between any two blocks. The patentees of the system are Major-General Webber, C. B., R. E., and Mr. T. O. Callender, of No. 101 Leadenhall Street.

A paper on "River Pollution Caused by Disposal of Sewage," read before the Society of Engineers by Mr. G. B. Jerram, C. E., called attention to the difficulty presenting itself in a proper chemical treatment of sewage, with a view to precipitation and deodorization, owing to the varying quantity and quality received at different times. He further pointed out that the escape of an excessive or undue quantity of chemicals into the river with sewage was of itself a pollution. It would precipitate any organic matter that might be present in the river and also the sewage that had previously been passed into the river in excessive proportions as compared with chemicals mixed.

SAFETY-VALVE.

IT seems to us the daily papers of this city are inclined to get up a needless alarm over the few cases of small-pox in this city. Our Health Department understand small-pox and are able to deal with it, and it is worse than useless to get up a scare until there is a prospect of doing some good.

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

FIRE-PLACE IN DINING-ROOM OF THE VILLARD HOUSE.—M'KIM, MEAD & WHITE, ARCHITECTS.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE AT PHILADELPHIA, PA.—JAMES H. WINDRIM, ARCHITECT.

THE subject of our vignette illustration this week is a residence belonging to the estate of Terrance McDonald, and located in Philadelphia. It is pressed brick, with brownstone trimmings. The cornice copings and cap moldings are of galvanized iron. The interior of the first story is of oak wood, and the upper stories are of white pine, natural wood finish, by filler and varnish. The cost was $6,500. Mr. James H. Windrim, of Philadelphia, was the architect.

MEASURING WATER.

WHY at the close of the nineteenth century water should have been sold by guess-work and every other necessary domestic article by measure, is one of the problems that students of political economy will puzzle themselves over a hundred years hence, if not sooner. It is so evidently wasteful and so manifestly uneconomical that it is a marvel that the business men of the country submit to the imposition. Mr. Benzenberg, the City Engineer of Milwaukee, Wis., has grouped together some interesting and instructive facts in this connection, his object being to show the taxpayers of his city that they are being swindled in the matter of their water-supply. Not that the Water Commissioners of Milwaukee are deliberately or intentionally allowing the people to be robbed. So far as we know they are honorable and worthy men, but nevertheless they allow the public money to be spent in pumping up annually into their reservoir about 5,000 millions of gallons more than the consumers of water use for any legitimate purpose or than they need. If those who made away with this extra quantity of water paid the bills, it would not be so bad; but they do not pay their share. The careless and wasteful user of water pays no more than the careful one, although there is three or four times as much coal and labor paid for by the city to furnish him with water as to supply his frugal neighbor. It can, we think, be easily shown that the annual saving in operating expenses consequent upon the application of meters to every service-pipe in Milwaukee would be more than double the interest on the cost of the meters. Besides this, every consumer would pay only for what he used and not be taxed for his neighbor's wastefulness.

The advantages to a community in making people pay for water wasted are forcibly set forth by W. G. Richards, Superintendent of the Atlanta, Geo., Water-Works, who, in his last report, says:

"I cannot close this report without again mentioning the very gratifying results that have been obtained through the universal use of meters. The waste has been stopped, the pumpage has been reduced to about one-third what it was prior to their introduction, the consumption of coal is also about one-third of what it was, we are enabled to give the firemen all the pressure wanted or required, we have been enabled to get the pumping machinery into splendid condition, we are carrying a uniform domestic pressure that is giving satisfaction at the highest altitudes in the city, and affording all the pressure required for the hydraulic elevators; the rate of insurance has been reduced and the insurance underwriters are pleased with the uniform efficiency of the works. There are no complaints or grumbling except the regular monthly growls from those who have to pay for neglect or carelessness in the shape of a big water bill. Whatever merit the water-works has is due to the meter system and the Board of Water Commissioners, aided by his Honor the Mayor, who displayed the nerve to require their universal introduction, and thereby save the water-works from becoming a wreck."

COHOES WATER-WORKS.

WE have received from Mr. Edward Hayes, City Engineer of Cohoes, N. Y., his report on the construction of reservoir No. 3 for the water-works of that city. It covers an area of 14½ acres, and stores 65,571,570 gallons when the water is 22 feet deep. As there was a surplus of earth, the banks were raised 2½ feet higher, and this will allow a storage of 74,073,609 gallons, still leaving a height of 5 feet below top of bank. The three reservoirs together will eventually store 95,000,000 gallons. The pressure at about the centre of distribution will be about 90 pounds per square inch.

Rock and hard-pan were met with on the west side, and the surface of the rock where cut was plastered with cement to prevent leakage through the seams. Work was begun July 13, 1885, and finished October 23 last.

The cost was $49,027.20, being $990.24 over the estimate. The cost, therefore, per million gallons of capacity was about $660.

Various changes in the rising mains are recommended, and also the introduction of a stand-pipe and fountain for purification by aeration, which can be done with but little cost.

THE WATER-SUPPLY OF ATTLEBORO, MASS.

ATTLEBORO, MASS., built works in 1873 to supply water for a district of about a mile in diameter, taking the water from Mill River. The population has increased greatly, and at the request of a committee, Messrs. M. M. Tidd, Mem. Am. Soc. C. E., and Percy M. Blake, C. E., have each examined the condition of the present works and the available sources for additional supply and submitted reports on the same.

Mr. Tidd finds that the present source of supply is polluted and that its capacity is too small in case of fire, and recommends that water be taken from Bungay stream and pumped into a reservoir 130 feet above the town. The cost of the works he estimates at $48,200.

Mr. Blake gives a summary of the progress of the works, from which it appears that in 1874, the original works, which cost $20,000, were enlarged at a cost of $42,000, a well taking water from a stratum of porous gravel being part of the improvement. In 1882, there being then 694 consumers, the supply was increased by building in the saturated gravel a brick collecting conduit 100 feet long, with five driven wells in it of 2-inch pipes. There are now 775 consumers and about ten miles of main pipes, and the work has cost $97,342.60.

The pumping machinery needs increasing, the reservoir capacity is too small, and the supply is insufficient and suspicious in character. Mr. Blake evidently favors the idea of combining the supply of Attleboro with that of North Attleboro, about four miles distant, where water-works have been recently built, the source of supply of which is capable of furnishing water for a population of 80,000. It is equally evident that the committee did not look with favor on this joint scheme, as the engineer proceeds, "without attempting any discussion of the important questions of expediency which are suggested by existing circumstances," to develop a plan for taking the supply from the ground-water of gravel-beds adjoining Bungay River, by means of a collecting-well thirty feet in diameter and twenty-five feet deep, lined with water-tight brick from a point two feet above the bottom to a level above high water in the river. This is to prevent percolation from the surface and confine the supply to the lower strata of saturated gravel. This will make a reservoir holding 120,000 gallons, from which it is proposed to pump the water through two miles of cast-iron pipe to a reservoir 189 feet higher, and 122 feet above the centre of the town. This work, with the mains necessary for completing the system capable of supplying 600,000 gallons a day, is estimated to cost $61,000.

THE possibilities of the art of casting metals do not appear to be generally appreciated, even by those most familiar with the process. The introduction of compression bronze 15 or 20 years ago showed that metals might be cast in a commercial way, with so fine a finish that no subsequent labor was needed. A single firm uses the process in making bronze hardware, but it has not been generally introduced, nor used for other metals. Now a process is in operation in Passaic, N. J., which produces equally fine work, but is applicable to brass and other metals. It will cheaply reproduce a copper-plate visiting-card with sufficient delicacy to print from. It can be used for any kind of ornamental work that is capable of being molded.

THE ANNUAL MEETING OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

CONTINUING our account from our last issue, we would note first an interesting exhibit by Mr. Worthen of a piece of wrought-iron water-pipe which had been in use for many years. Cast-iron pipes 8 inches in diameter were described which were put in in 1829 for use under a 50-foot head, and were now in use under a 200-foot head.

A peculiarity was mentioned by Mr. Graef of the butt-jointed 7 foot wrought-iron pipe in use for carrying the Croton water across High Bridge. There were sleeves about 8 inches wide riveted over the joints and calked, and the remarkable fact was stated that the interior of the pipe was not corroded at all at the parts where the sleeves cover the pipe.

Genl. Greene mentioned some cast-iron plates used in the invert of the Croton Aqueduct at a point where it crossed over a valley. These were bedded in cement, and a four lining of brick in cement placed inside, and they were as perfect when torn out after 40 years' use as they were when buried.

Mr. Graef mentioned cast pipes on a line two miles long running partly through clean dry shore sand and partly through gravel and earth. Those in sand were so perfect externally that the skin was scarcely disturbed. The remainder were much corroded, and some of them left in a yard during winter fell to pieces. After some other discussion of the subject the meeting adjourned until evening.

At the evening session Mr. Charles Macdonald read a fully illustrated paper on "the 600-ton testing machine at the works of the Union Bridge Company at Athens, Pa." This is a very interesting piece of construction, calculated to break eye-bars up to 40 feet long, and, when arranged for it, to test columns up to 44 feet long. A piece of steel eye-bar of original section 8x2.23 inches, or of 17.84 square inches, was exhibited, which had been broken on the machine. The ultimate load was 1,187,050 lbs., or per square inch 66,539 lbs. The elastic limit 33,955 per square inch. The stretch on 11 feet was 16.14 inches. The original diameter of the hole was 7 inches, and it was elongated $1\frac{1}{4}$ inches. The reduction of area was 40.42 per cent.

This was one of several tested for the work on the Hawkesbury Bridge.

The cylinder of the ram is 4 feet $3\frac{3}{4}$ inches in diameter, and has but one head; the stroke is 4 feet 11 inches, and at 600 lbs. per square inch the pressure exerted is 1,223,400 lbs.

The wrought-iron girders are 60 feet long and 3 feet $5\frac{5}{8}$ inches high, and they rest on 12-inch cross girders every $13\frac{1}{2}$ feet, which are anchored to masonry piers.

The tail block is easily attached to the girders by pins at intervals of eighteen inches; and the finer adjustment of length is made by changing the acting length of four tension rods, attached to the block through the means of adjusting screws on their ends actuated by a pinion and shaft. Provision is also made for taking up the recoil following rupture, by friction on a central rod.

The piston is packed by the ordinary woven flax packing, well tallowed. There are six rings of it, and they are set up by a gland, until when in use a thin film of water escapes uniformly around the piston. It is found that the piston can be returned to place after a test by a vaccum of $1\frac{1}{2}$ pounds per square inch, equal to 3,000 pounds on the whole ram, and this is obtained by discharging the water through a pipe reaching $4\frac{1}{2}$ feet below the ram. It is claimed by the author that this is probably the full amount of friction caused by the ram when in use. The machine was designed by Mr. Charles Kellogg, Mem. Am. Soc. C. E.

The paper closed with some remarks on the present status of the U. S. testing machine at Watertown, pointing out the great necessity for a *smaller* machine, so that the larger one may be kept for its legitimate use—viz., the accurate testing of large specimens, for which use it stands unrivalled in its absolute accuracy.

Communications were read from Mr. L. G. F. Bouscaren, and also from Mr. Parker, in charge of the testing machine at Watertown. The latter gave details of the great amount of work accomplished by the U. S. machine, and thought the criticism by the paper uncalled for.

Mr. Morrison defended the paper, saying that the results of some tests made for the Blair bridge were not received until several months after the bridge was opened for traffic.

He thought that while there might be an element of uncertainty in the friction of the machine just described it was accurate enough for most practical purposes.

Mr. A. H. Emery, the inventor of the main features of the U. S. machine, claimed that the friction was entirely an uncertain element, and might amount to 10 per cent., or even more, especially since the cylinder was light and subject to deformation under strain, which might cause an entirely abnormal increase. He showed also that the gauges for these high pressures would not read the same when the pressure was increasing as when it is diminishing.

Mr. Charles E. Emery showed how the attachment invented by him for giving a rotary motion of the piston up to 100 times the *advancing* motion practically eliminated the friction.

Mr. Theodore Cooper criticised Mr. A. H. Emery's conclusions, saying that the many experiments on the steel for the St. Louis bridge did not bear them out. He promised a record of them at some future time.

Colonel W. H. Paine stated that in the grips for cable roads leather was found to give the *greatest* friction of any substance tried, and that water by its lubricating effect seriously interfered with the use of the grips.

Mr. Collingwood made the point, that it is contrary to all our experience that a substance like the film of water mentioned having a velocity *greater* than the piston, and moving in the *same* direction, could have a deterrent effect, or, in other words, produce friction on the ram.

The society then adjourned.

On Friday the society met at the Twenty-third Street Station of the Elevated Road on Second Avenue, and by invitation of F. K. Hain, General Manager, and S. R. Filley, Esq., President of the Suburban Line, took an excursion over the line. On the return the draw-bridge across Harlem River was inspected. A steamer was then taken to the Continental Iron-Works (Thomas F. Rowland, Vice-President of the society, proprietor). Here an elegant lunch was served, and the party then inspected the works. The chief point of interest was the steel-welding process by the use of water-gas.

The gas and air for combustion were delivered in separate flexible pipes into a square iron box lined with fire-brick and open at the bottom. This was placed over the object to be heated, and in a short time it was ready for welding. This is done either by hammering or rolling. Some marvelous pieces of forging were exhibited, such as a bottle about three feet long, almost identical in shape with a ginger-ale bottle, also spherical torpedo-cases with their attachments complete.

The machine for making corrugated boiler-tubes was examined with much interest; also the gas-apparatus, some interesting special lathes, etc. The steamer was then taken to Bedloe's Island, where, under the escort of Captain J. N. Fessenden, U. S. A., the Statue of Liberty was visited. It was a disappointment to many that more light was not furnished, as it was impossible to form any idea of the frame-work in the almost total absence of light on the interior. However, in parties of fifteen, those who wished succeeded in reaching the balcony, so as to say they had "been there," and to reach *terra firma* with nothing more serious thana n occasional bump of the head against an unseen bar.

In the evening there was a delightful reception at the society rooms, breaking up at a late hour.

Invitations were received also from Mr. Charles E. Emery to visit the Steam-Heating Works, from Mr. C. C. Martin to visit the Bridge works, and from Colonel W. H. Paine to visit the cable road.

THE Technical High School at Charlottenburg, near Berlin, has had the efflorescence on its building examined chemically, with the following result:

Soluble portion:

Sulphate of potassa	32.38 per cent.
Sulphite of soda	26.83 "
Gypsum	0.60 "

Insoluble portion:

Carbonate of lime	5.32 per cent.
Clay and oxide of iron	0.52 "
Silicic acid	0.22 "

The remainder, 34.13 per cent., consisted of sand, which came partly from the mortar, but chiefly from the street dust.

The building was of sandstone ashlar laid in cement mortar.

The formation of the first two salts is explained by the *Thonindustrie Zeit* to be due to the presence of alkalies and gypsum in the cement, the latter being either added artificially or arising from the reactions of the sulphur in the burning gases with the lime.

UNDERGROUND TELEGRAPHS IN GERMANY.

THE Berlin correspondent of the London *Times* has received from Dr. Van Stephan, Imperial Postmaster-General, an account of the underground system of telegraph conduits in Germany.

Such a collapse of telegraphic communication, he says, as lately plunged England into something like Egyptian darkness would be impossible in Germany, for Germany is enclosed in an elaborate net of underground wires. These were first taken in hand in the year 1876—Berlin to Halle being the first line laid—and by 1881 the project had been completed. This net, which includes all the chief commercial and military centres of the Empire, extends from Königsberg in the north-east to Metz and Strasburg in the west, and consists of trunk and branch lines, forming a total length of about 5,463 kilomètres of cable, or 37,372 kilomètres of telegraphic wires, each cable comprising from seven to four wires, according to the pressure of intercourse in various districts. The total cost of laying this 5,463 kilomètres of cable was only 30,200,000*m.*, or little more than one and a half million of pounds. So that the paltry expense of connecting London and Lowestoft or London and Dover by underground wires can easily be calculated. As far as time is concerned, the cable, for example, between Berlin and Halle, 176 kilomètres, was laid in about three short months; and what could not English energy accomplish in the same period? All the cables only require a narrow trench one metre deep, this being quite sufficient to protect them from the extremes of soil temperature, whether heat or cold. They generally follow railway routes or turnpike roads, these, as a rule, forming the shortest available distance between two given points. It is true that the overhead wires work a little better *ceteris paribus* than underground cables, owing to the effect of what is technically called induction on the conducting power of the copper wires; but on the other hand the expense of maintaining the former in good order is sometimes as much as 19*m.* per annum for every kilomètre, while the latter cost next to nothing, and this in itself is surely a very serious consideration. It must not, of course, be supposed that in Germany the overhead system of telegraphy has been discarded; on the contrary the great bulk of correspondence is still forwarded over pole-supported wire, but as the German army is organized on the basis not only of regimental but also of strategic reserves, so the telegraph system of this wonderful nation also provides for all emergencies of snow, lightning, thunder, roving Cossack, or invading Gaul. It was probably the military necessities of the Empire as much as anything that gave rise to the idea of a telegraph cable net, but meanwhile the ordinary and every-day interests of the country profit greatly by its existence.

To Germany belongs the enterprise and the honor of leading the way in this direction and France is the only other nation which has imitated her example, though as yet to a very timid and limited extent. Efforts have been made in Berlin to induce France to connect Paris with the German frontier by a subterranean wire, but hitherto this object has not been attained. The violent storms which swept over Europe, in January, 1884, interrupted telegraphic communication for a brief but painful period in England, France, and Belgium, but they affected not the intercourse of Germany with her underground wires, and the same can be said of the recent heavy snowfall, which stopped traffic for a few days on all the chief lines. As to the question who is most to blame in England for the late catastrophe, the Government or private companies, it is pointed out by the *North German Gazette* that the concession of the Submarine Company not only holds good for the transmission of messages over the sea line, but also for the land route between Dover and London, "so that the company has, in point of fact, control of all the international intercourse by this route, and ought also, therefore, to provide for it." In any case it is earnestly hoped here that the question will now be seriously considered and solved in the only possible manner either by the Government or the company, or both.
—*Berlin Correspondent of the London Times.*

A. T. MYERS writes in *Nature* of December 30, 1886, apropos of Dr. J. S. Billings's "Index Catalogue" of the Library of the Surgeon-General's office at Washington: "It is easy to show the vast extent of the work attempted and executed. That there are absolutely no inaccuracies in the result is hardly possible, difficult as it may be to find them. The references in this volume certainly stand many tests, and most of those who have made frequent use of the previous six volumes in practical work have acquired a confidence in their accuracy which is very rare in dealing with such an immense mass of varied languages and types and abbreviations so thickly interspersed with figures."—*N. Y. Post.*

ALUMINUM compounds are just now fashionable subjects for mechanical engineers. One of the latest is aluminum and wrought iron. When a fraction of one per cent. of aluminum is added to wrought iron at a white heat, the melting point of the wrought iron suddenly drops nearly 600° Fahr., and the iron becomes so fluid that it can be cast as easily as Scotch pig and appears to be nearly as liquid. The character of the metal is not changed in any way, and the castings work like forgings. The process will probably make a new and very valuable field for itself.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. IX.

(Continued from page 183.)

THE breast-derrick illustrated in Fig. 37 is a well-known form. Its ready movement along the face of a wall by means of the rollers in the bottom beam and the easily adjusted guys make it a favorite with builders. Several sizes of these were used in the building. The crank-axles for the hand-hoist on all these derricks is made to be readily slipped lengthwise, so that the pinion can be thrown out of gear for quick lowering. A pivoted latch, acting against a collar on the shaft, serves to retain it in place when in use.

Figure 38 shows another form of derrick used in stone-setting, etc. It will be seen that it is guyed and stayed in a similar manner to the one just described. It is found that by having an adjustable attachment at the lower end of the wire rope guys much trouble is saved. This consists in putting the rope around an 8-inch sheave which is secured to a beam or some other permanent fixture, and then putting on cast-iron clamps, as shown. These are safe for moderate loads, for which two at least should be used, but for heavy strains the only safe rule is to put on ample "seizings" of sufficient strength to prevent all danger of slipping. The foot of the boom has thin iron plates at the sides where it comes in contact with the bracket, and the boom is supported on a 1½-inch bolt passing through it and the checks of a cast-iron bracket, as shown. For safety a wooden chock is bolted fast to the mast under the bracket.

An important detail in all derricks is the foot-step. The pin shown here is 2¾ inches in diameter. As the top of a derrick always has some lateral motion, particularly while being set up, it is important to flare the cup of the foot-step, since the step is almost sure to be cracked if this is neglected.

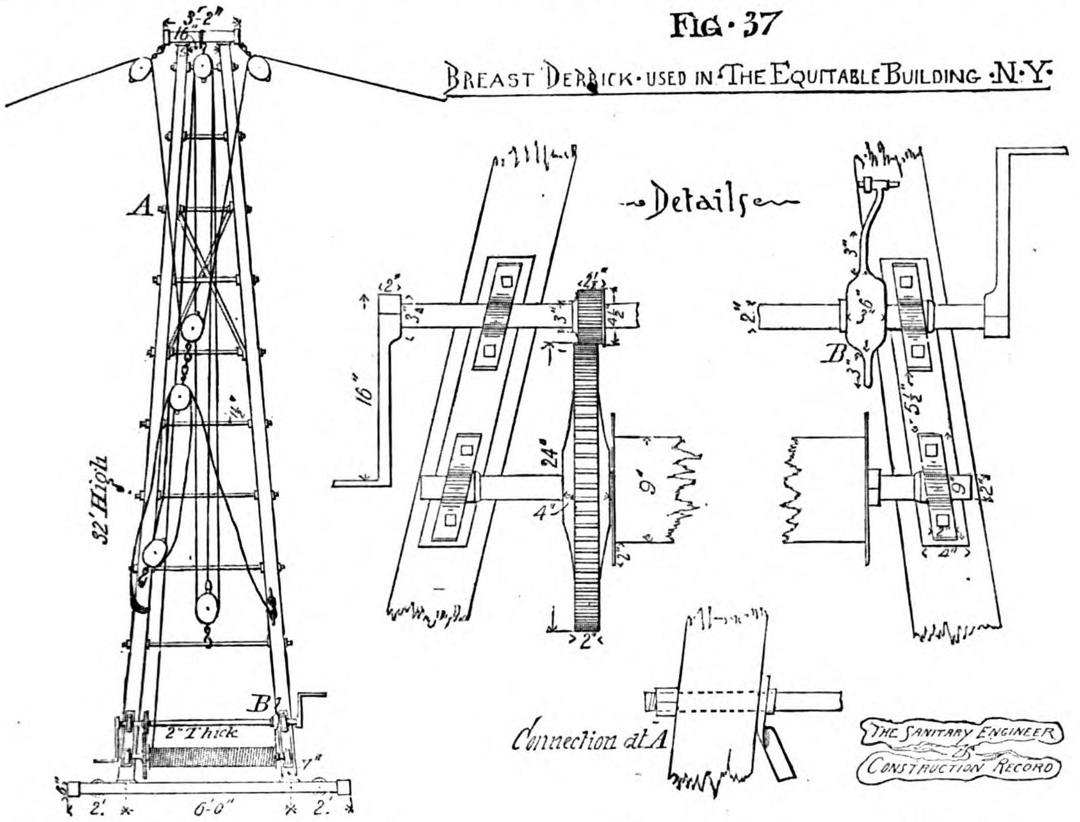
There are two falls to this derrick, one for manipulating the boom and one for the hoisting. These are run to snatch-blocks, as shown, near the foot of the mast, and thence to the engine. As the engine used in this place was especially constructed for the purpose we hope to illustrate it at a future time.

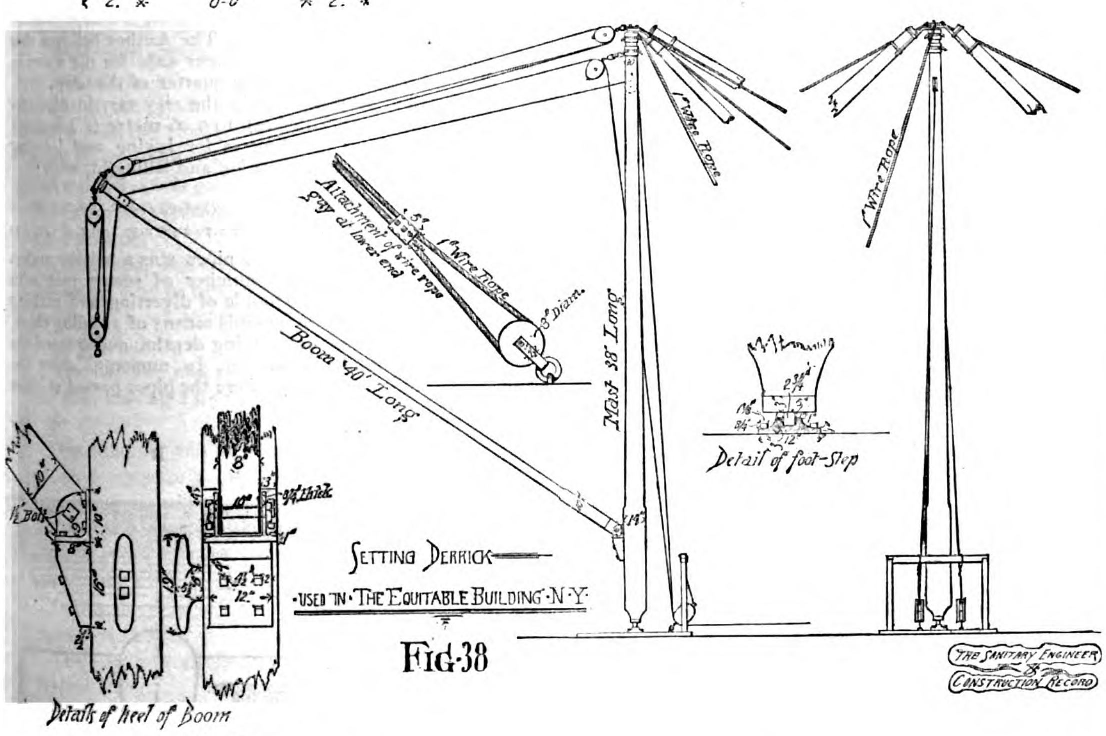
One manifest advantage of derricks with a horizontal boom over those with inclined boom is the less frequent raising of the derrick itself that is required, as the boom of the latter allows a less height of masonry to be set without interference.

The trucks used for transferring stone and other heavy loads are illustrated in Fig. 39. The dimensions are clearly given, and it needs no further description than to say that all parts are of iron except the platform and bolsters, which are of oak.

FIG. 37

BREAST DERRICK · USED IN THE EQUITABLE BUILDING N.Y.





SETTING DERRICK USED IN THE EQUITABLE BUILDING N.Y.

FIG. 38

STONE TRUCK USED IN THE EQUITABE BUILDING N.Y.

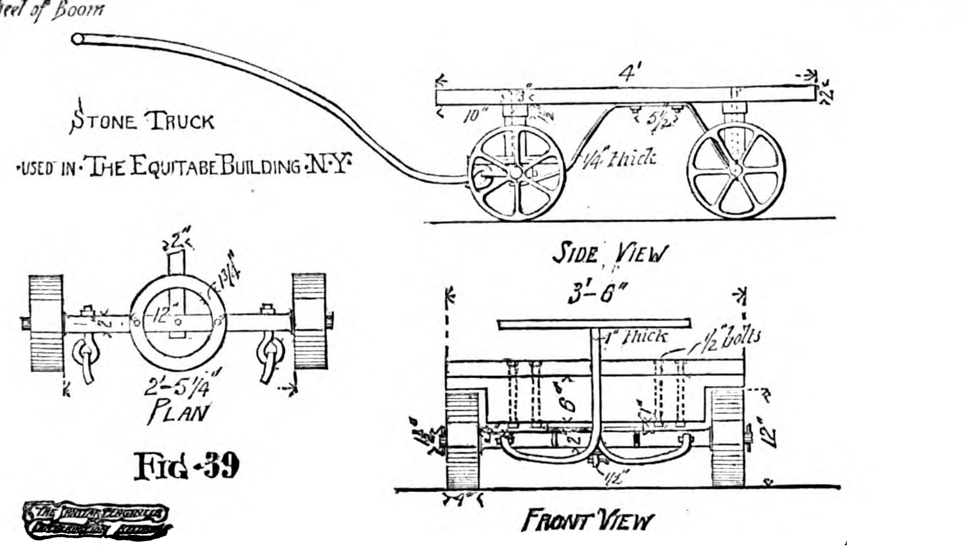


FIG. 39

CONSTANTINOPLE WATER-WORKS.*

THE city of Constantinople is divided into two parts by the Golden Horn, its eastern shores being bounded by the Bosphorus and the Sea of Marmora. Galata and Pera, the European quarter of the city, stand on the northern side of the Golden Horn, the former on the seashore, and the latter on high ground above it; and Stamboul, the ancient and native portion, is on the southern shore; communication is established between them by two iron bridges, which open for the accommodation of shipping, sufficient headway not being obtainable owing to the extreme flatness of the banks. The villages on the European shores of the Bosphorus—namely, Ortakeui, Kourouchesme, Arnautkeui, Bebek, Therapia, and Buyukdere—have of late years become the summer resort of the wealthier classes of the city, and in estimating the population it is necessary to include these villages.

The existing sewers, or, more correctly speaking, longitudinal cesspools, are square in section, put together in the roughest manner, and consequently rarely water-tight; they are laid invariably with insufficient fall, the solid matters thus remaining in them until they become choked, when portions are opened and cleansed, poisoning the air for hours afterwards. The contents of these channels are finally discharged close to the most densely populated districts of the Golden Horn.

The supply of water has always been limited, and, with such disadvantages, it might well be imagined that the city would be rarely free from epidemics. This happily has not been the case, the most alarming outbreak having been one of cholera in the year 1865, when upwards of two thousand persons perished daily.

A marked improvement has taken place in one portion of the town during the last two years, especially since the tramway lines have been laid down. Part of the Grande Rue de Pera and the Rue Tèpé Bachi are now decently paved, and a spacious club, and new opera house have been erected, together with several private residences.

The population of Galata and Pera, together with the villages on the European shores of the Bosphorus, is about three hundred and sixty thousand. The highest part of Pera is Chichly, which is 370 feet above sea-level. Stamboul, the ancient city, has a population of about four hundred and twenty thousand persons, and its highest ground is about 260 feet above sea-level. To the above estimate must be added about five thousand for the floating population of the city, making up a total population of about seven hundred and eighty-five thousand persons.

The city is at present supplied from the reservoirs, or "bends" (this being the local term), situated at Chioy, Belgrade, Pergos, etc., the water being conveyed thence by aqueduct to service-reservoirs in different parts of the city. These "bends" are situated on the slope of a range of hills, which are a south-eastern prolongation of the Balkan mountains. The works were carried out under the later Roman emperors, and both in design and in construction they compare favorably with any work of recent date.

It is only in the details of the distribution that the constructors appear to have shown any ignorance. The pipes which convey the water from the small reservoirs to the

* Republished from a paper by Frederic Briffault, Assoc. M. Inst. C. E., in the Proceedings of the Institution of Civil Engineers.

public fountains and to some of the houses are of lead, and vary in diameter from twenty-five millimetres (0.98 inch) to sixty millimetres (2.36 inches); lines of these pipes are laid through the streets and are easily damaged, their thickness being little more than that of a sheet of paper. In many houses large marble cisterns occupy the whole area of the basement, in which rainwater is collected.

The annual rainfall, from observations extending over a series of years, amounts to seventy-one centimetres (28 inches); but in a dry year, after deducting loss by evaporation and absorption, not more than about five inches can be reckoned upon for collection, which (considering the limited water-shed available) is a quantity wholly inadequate for such a population as that of Constantinople.

In 1882 a company was formed under the auspices of La Compagnie des Eaux de Paris, with a capital of 20,000,000 francs (£800,000), to procure a supply of water for the city from Lake Derkos, near the Black Sea.

Lake Derkos is a fresh-water lake having a depth varying from about ten to twenty feet, and an area that may be roughly computed at about 10,000 acres. It is cut off from the Black Sea on its north side by sand-hills or dunes; the channel between them, a comparatively narrow passage, has now been blocked by dams, so that the sea is prevented from entering the lake, and the level of the latter has been raised. The water for the present is taken in at Kizildere, at the western extremity of the lake, where the principal feeders flow in. The intake-tunnel commences at this point, and follows the northern contour of the lake through the sand-hills until it reaches the well at the pumping-station at Derkos.

The upper portion of the tunnel is laid with open joints, and the water falling upon this large area of sand, to a great extent percolates into the tunnel and thus greatly augments the supply. A main is also laid, with branches and screw-cocks parallel with the tunnel, to draw from the lake itself when desirable.

The pumping-station is situated near the village of Derkos, which is about 29 miles from Constantinople, and 4⅓ miles from the port of Karabournou on the Black Sea. The level of the floor of the engine-house is 1 metre (3 feet 3 inches) above the highest level of the water of the lake, or 2.5 metres (8 feet 2 inches) above that of the sea.

The engine and boiler-houses have been designed of sufficient dimensions for six pairs of engines and twelve boilers, to furnish a daily supply of 40,000 cubic metres (8,800,000 gallons), but as the company only contemplates supplying 13,333 cubic metres (2,933,260 gallons) for the present, only three pairs of engines and six boilers have been laid down. These collectively are capable of pumping 20,000 cubic metres (4,400,000 gallons) to a maximum height of 125 metres (410 feet) in eighteen hours.

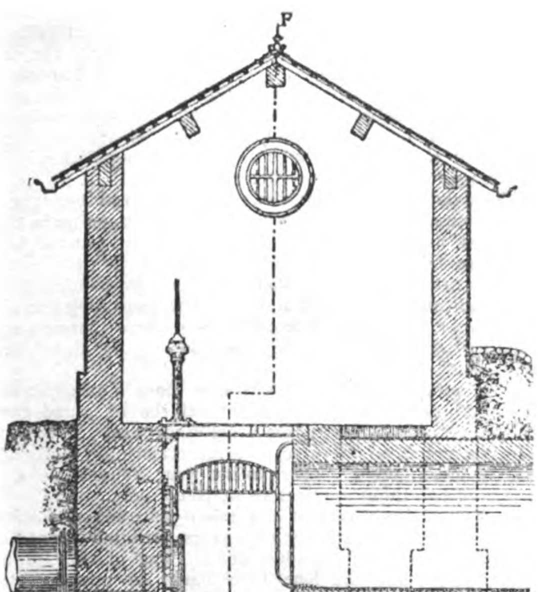


Fig. 1.
Syphon Inlet-Chamber.
Section on line G H of Fig. 2. Scale ⅛ inch = 1 foot.

The engines are high-pressure and horizontal, of the direct-acting type, of 600 horse-power (French) collectively, driving double-acting piston pumps. Each pair is coupled, but each engine can be worked independently. Their normal speed is 16 revolutions per minute. They have jet-condensers, and the feed-water is supplied to the boilers at a high temperature. The cylinders are 0.9 metre (2 feet 11 inches) in diameter, with a length of stroke of 1.8 metre (5 feet 11 inches), and the pumps 0.262 millimetres (10.32 inches) in diameter, having the same length of stroke as the engines. The cylinders are steam-jacketed, variable expansion being effected by two independent slide-valves, one valve for admitting and exhausting the steam, and the other for cutting off at any point of the stroke. Steam is supplied by six double-flued boilers with Galloway tubes at a pressure of 5.25 atmospheres (78 lbs.).

The water is raised to a height of 109 metres (358 feet) through a pumping-main 0.60 metre (24 inches) in diameter, 2.17 miles in length, into a reservoir near the village of Derkos. It is built in four compartments, having a total capacity of 1,043,539 gallons, and a depth of water of 10 feet. The walls are of limestone rubble, the piers for the arches being of squared stone. By-pass pipes and valves are arranged so that the conduit can be supplied direct, without the water passing into the reservoir. On leaving this point the water flows by gravitation through a built aqueduct and syphon-pipes a distance of 26.66 miles to the service-reservoir at Ferekeui, on the high ground at Pera, the top-water level of which is 295 feet above the sea. There are a few short lengths of tunnel on the line of the same form as the aqueduct. The continuity of the aqueduct is broken by valleys fifteen times on the way to Ferekeui. Cast-iron syphon-pipes 24 inches in diameter are therefore laid across them. Their general arrangement in the inlet and the outlet-chamber is shown by Figs. 1 to 4. The conduit is 5 feet 3 inches in height by 3 feet 5 inches wide. Like the reservoirs, the aqueduct is of rough rubble limestone, rendered in cement up to the springing of the arch, the crown of which together with

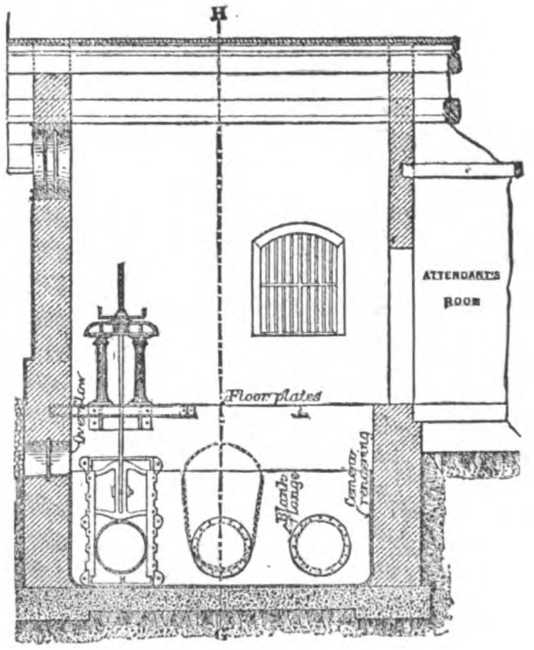


Fig. 2.
Syphon Inlet-Chamber.
Section on line EF of Fig. 1. Scale ⅛ inch = 1 foot.

the exterior of the syphon-chambers is floated over with a layer of hydraulic lime-mortar. The syphon-wells are rendered in cement up to the water-level.

At the inlets of the longest syphon-pipes, there are buildings with accommodation for an attendant. Sluices are fixed at each of these stations, to shut off the water from each section of pipe in the event of fracture. The formation through which the aqueduct passes is chiefly schist, which is of considerable depth resting upon carboniferous limestone. This schist or slate-rock is in many parts extremely hard, and has given much trouble to dislodge. The surface soil is principally clay. For the present, only

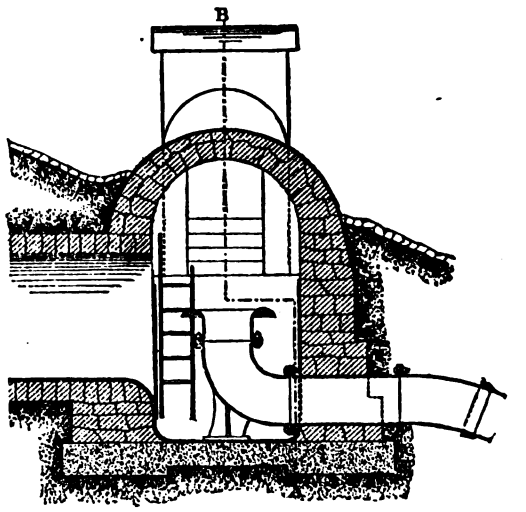


Fig. 3.
Syphon Outlet-Chamber.
Section on line C D of Fig. 4. Scale ⅛ inch = 1 foot.

one syphon-pipe 24 inches in diameter has been laid down, which is sufficient for the present supply of 13,333 cubic metres (2,933,260 gallons); as the demand increases two more will be added, the three pipes giving the full supply for which the aqueduct has been constructed. In the fifteen syphons before mentioned there is a length of about 6.66 miles of cast-iron pipes, and about 20 miles of aqueduct and tunnels.

The difference of level between the reservoir at Derkos and the service-reservoir at Pera is 19.50 metres (64 feet). This gives a fall of 2.4 feet per mile, which is proportioned between the aqueduct and the pipes.

In order to supply Chichly, the highest part of Pera, it has been necessary to construct a small reservoir at the former place, the top-water level of which is 114.50 metres (375 feet) above the sea. To accomplish this a turbine has been fixed at a point 82 feet below the Ferekeui reservoir, a supply-pipe 0.40 metre (16 inches) in diameter being led therefrom to the turbine. This gives the necessary power to work the pumps, and raise the water to a height of 162 feet, which gives ample pressure for this district. The water for working the turbine is led into the main for furnishing the European shores of the Bosphorus.

There are three equilibrium reservoirs for the villages of the Bosphorus, all of which are constructed in two compartments; the details are as follows:

	Capacity of each Division.	Depth of water.	Height above Sea.
	Gallons.	Feet.	Feet.
Arnautkeui.......	550,000	13.77	170.50
Boyadkeui.......	330,000	10.82	137.77
Kiretche Bournou	165,000	10.82	105.00

The reservoirs at Ferekeui and Chichly are also built in two divisions, each compartment of the former holding 1,760,000 gallons, and having a depth of water of 16.40 feet. The latter contains 770,000 gallons to the compartment and has a depth of 16.40 feet. All six are covered reservoirs, built of limestone rubble and rendered with a thickness of 1 inch of cement-mortar to the top-water line.

There are thus three services, one high at Chichly, another intermediate, at Ferekeui, and the third low for the Bosphorus; by an arrangement of valves they can all be coupled together and the water made to circulate. Loaded safety-valves are fixed on the pumping-main and self-acting double air-valves on the syphon-pipes on all the crests, and wash-out valves in the depressions; lead and yarn joints have been employed throughout.

The transport of the large pipes was a matter of difficulty, owing to long distances to be traversed, and the badness of the roads in winter, but more especially from the trouble of obtaining laborers. The breakage in discharging the pipes and castings from the steamers to the lighters (their being no quays suitable for vessels to come alongside) and from the latter to the shore was very great at the commencement. The syphon-pipes were 11/16-inch thick, and weighed on an average 19 hundredweight each.

It may be thought that the quantity of water provided is very small for such a population as that of Constantinople; but no industry worthy of the name is carried on. No breweries nor works of any kind require large supplies of water, the only large consumers being the hotel and restaurant proprietors, and a fair supply for the Sultan's palaces. Too much reliance must not be placed upon the whole of the native population taking the water, amongst a large portion of which great poverty prevails. The Author believes that the company will have a far greater sale for the water in the European than in the native quarter of the town.

The distributing pipes within the city vary in diameter from 0.35 metre (13.8 inches), to 0.06 metre (2.4 inches). The prices paid per lineal metre for laying and jointing the pipes, exclusive of excavation and filling in, were:

Diameter of pipe in metres.	0.60	0.50	0.40	0.35	0.30	0.25	0.20	0.15	0.10	0.08	0.06
Price in francs . .	4.45	3.75	3.26	3.08	2.79	2.74	2.37	1.93	1.28	1.01	0.52

The laying of most of these pipes was a tedious undertaking, principally from the number of sewers met with every few yards, and the trouble of diverting and making them good; there was no possible means of avoiding them. They were encountered at varying depths, and crossed the street in the most erratic manner. In numerous cases the houses had to be shored up where the pipes passed at close

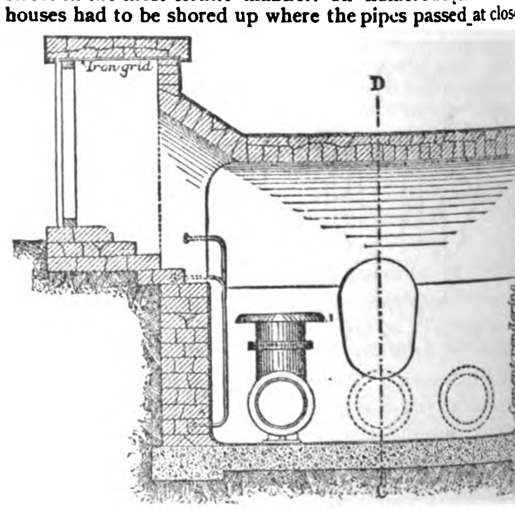


FIG. 4.
Syphon Outlet-Chamber.
Section on line A B of Fig. 3. Scale ⅛ inch = 1 foot.

quarters, as many of them have hardly any foundations, and there was danger of bringing them down altogether. The dead-ends of the small pipes are connected to other mains wherever practicable, to prevent the water becoming stagnant.

A limited number of fire-hydrants has been fixed. These are of a screw-down kind, with gun-metal spindles and loose valves with leathern washers enclosed in lock-up surface-boxes. The number, however, will have to be greatly augmented, as the fires occurring in the city are very numerous, and the loss of life in consequence is very great; and, up to the present time, no practical means have been adopted for extinguishing them.

The house-services are arranged on the French system, with the clip round the service-pipe, and the plug-cock

screwed into it; the piping is of lead, varying from 13 to 55 millimetres (0.51 inch to 2.16 inches) in diameter.

In the town mains the pressure of water is equal to a head of from 50 feet to about 280 feet in the low parts of the city.

The consumers will be chiefly supplied by Fragert's double piston-meter. The average charge per cubic metre (220 gallons) will be 3.5 piastres, 7¼*d.* (2*s.* 8¾*d.* per 1,000 gallons), special arrangements being made by the year for the larger consumers.

The works were commenced in the spring of 1883, and were completed in January, 1885, and opened on the 26th of that month.

M. Paul Bouton, Ingénieur en Chef des Ponts et Chaussées, of Paris, was the Chief Engineer and director of the works. The aqueduct and reservoirs were carried out by local contractors—the average cost of the aqueduct per lineal metre having been 95 francs.

The engines and boilers were constructed by La Compagnie de Fives-Lille (Nord), France, for 600,000 francs. Messrs. Dalmas & Cie., of Marseilles, supplied the house-service fittings and all laying on to the houses. The pumping-main, syphon-pipes, distributing-mains, and special castings, in all about 9,340 tons of cast-iron, were supplied by Messrs. R. Laidlaw & Sons, and Messrs. Thomas Edington & Sons, of Glasgow. The sluice-valves, sluices, hydrants, etc., have been provided by the Glenfield Company of Kilmarnock, N. B.

At the present time (October, 1886), four thousand houses in Pera are being supplied by this company, equal to a consumption of about 50,000 gallons of water per day; and it is anticipated that this quantity will be more than doubled within the next twelve months.

The paper is accompanied by several diagrams, from which the figures in the text have been prepared.

REPORT OF THE DEPARTMENT OF PUBLIC WORKS IN 1886.

General John Newton, Commissioner of Public Works of New York City, has transmitted to the Mayor his report of the transactions of the Department for the quarter and year ending December 31, 1886, of which the following is a synopsis:

Expenditures for the quarter, $1,153,833.57; expenditures for the year, $3,514,915.31.

One hundred and ninety-six contracts were made during the year, the estimated cost of which is $1,826,381.49.

Ninety-one contracts were completed amounting to $1,313,382.34.

During the year, 5,270,000,000 gallons of water were drawn from the storage-reservoirs and lakes in the Croton basin for the water-supply through the Croton Aqueduct, and 2,670,000,000 gallons of water were drawn from the Bronx River reservoirs for the supply through the Bronx River conduit.

Twenty-four and one-half miles of water-pipes were laid during the year in extending the water service. There are now 604 miles of water-mains, with 6,284 stop-cocks, and 7,838 fire-hydrants.

Nine hundred and two water-meters were placed during the year, making 14,582 meters in use at the close of the year.

One hundred and thirty thousand eight hundred and twenty-five square yards of new pavements were laid in repaving streets, and 22,486 square yards of pavements were laid in new streets in the upper part of the city. There are now 364½ miles of paved streets in the city south of the Harlem River.

During the year 3¾ miles of sewers and 42 receiving-basins were built.

There are now 414$\frac{1}{10}$ miles of sewers in the city south of Harlem River.

There were 36$\frac{65}{100}$ miles of gas-mains laid during the year, making a total of 927½ miles of gas-mains now under the streets of the city. The total length of streets lighted by public lamps is 464 miles. There are 24,194 gas-lamps, 711 electric-lights, and 120 naphtha-lamps, now in use in the streets, parks, places, bridges, and docks of the city.

The department made 1,459 seizures and removals of obstructions in streets, and removed 1,683 cart-loads of stone and other refuse material.

Seven thousand and fourteen permits were issued to place building material on streets.

The amount of revenue from the water service collected by the department for the year 1886 and paid into the City Treasury is $2,358,121.11, being an increase of $223,445.28 over the amount collected in 1885.

The department also collected and paid into the City Treasury for vault permits, sewer permits, etc., $107,924.94.

ENGINEERS' CLUB OF ST. LOUIS.

The club met January 19, President Potter in the chair, and twenty-six members and six visitors present. The following applications for membership were announced and referred to the Executive Committee: Arthur J. Frith, endorsed by J. A. Seddon and F. E. Nipher; Charles H. Ledlie, endorsed by F. H. Pond and T. J. Whitman; Edward K. Woodward, endorsed by W. H. Bryan and C. W. Melcher.

Robert Moore, Chairman of the Committee on Relations with the Mercantile Library Association, reported having addressed a letter representing the views of the Committee to the Board of Directors. The letter has not yet been acted upon, but a reply was expected in time to report at the next meeting. The committee was continued.

The special order of the day, a paper by H. S. Pritchett on "Mexican Longitude Determinations," was then taken up. The paper was fully illustrated by the aid of a magic lantern. A description of the apparatus used, the method of making the observations and of computing the results were explained, and the results were compared with those previously obtained by other methods. The professor showed a number of views of Mexican scenery and points of interest, with some remarks on peculiar features of the country and the characteristics of its people. After answering some questions, an invitation was extended to visit the Time Department of the Washington University.

Milwaukee, Wis., January 19, 1887.—The City Attorney has been requested by the City Engineer to prepare a bill to be submitted to the Legislature compelling every consumer of water in the city to use a meter. This measure, when adopted, will be the most effective way of stopping the present enormous waste of water. It is one that will no doubt be opposed by water consumers, as the meters cost from $14.50 to $40. It will not be necessary to erect new pumping-engines if meters are put in. The crusade against the willful waste of city water continues. There are about 750 meters in use here, and they have proved very satisfactory, both to the consumers and the Water Department. There are about 14,000 taps in, and we should at least have 6,000 meters in use. Where the water is found running, it is shut off at once and consumers notified to put in water-meters or go without water.

The Ohio Institute of Mining Engineers met in Columbus January 14.

The Secretary of the Treasury urges Congress to appropriate $7,500 to make good deficiencies in the appropriation for the past year for the National Board of Health.

Washington, D. C., builders have appointed a committee to take to Congress a protest against certain of the Building Regulations of that city.

The Ohio State Board of Health has begun an inquiry, by circular letters, into the sanitary condition, heating, ventilation, and lighting of the school-houses of the State.

The Illinois State Association of Architects held an adjourned meeting in Chicago, January 15, and continued consideration of the proposed State law governing the sanitary construction of buildings.

The San Francisco Chapter of Architects has appointed a committee to consult with the Board of Freeholders in reference to creating a Board of Public Works. Messrs. Wright, Wolf, and Gash are the committee.

The Builders' and Traders' Exchange, of Chicago, at the annual meeting, January 17, elected George H. Tapper, President; M. Benner, Vice-President; A. W. Murray, second Vice-President; F. C. Schoenthaler, Secretary; Joseph Downey, Treasurer; and O. Solliot, P. Henne, D. V. Purington, J. John, and M. Campbell directors for two years. There are over 498 members, and the treasury has a balance of over $2,000.

The Ohio Architects' State Association met in Cincinnati January 20. The following officers were elected: C. F. Schweinfurth, of Dayton, President. Vice-Presidents, W. M. Aiken, Cincinnati; F. S. Barnum, Cleveland; C. O. Stribley, Columbus; C. I. Williams, Dayton; E. O. Fallis, Toledo. F. A. Coburn, Cleveland, Secretary. H. C. Lindsay, Zanesville, Treasurer. Executive Committee, Messrs. Yost, Weary, and Rapp.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

HOW A HEATING-APPARATUS MAY BE DESTROYED BY AN IGNORANT ENGINEER.

——, January 12, 1887.

Sir: The closing paragraph in the valuable work on "Ventilation and Heating," by John S. Billings, M.., LL. D., has been given a particular emphasis in my recent experience. Our worthy Board of Education, when selecting plans for a new school building, wisely decided on one which embraced a system of heating and ventilating similar to that in the High School at Bridgeport, Conn., which merited by its novelty and efficiency the graphic description given in The Sanitary Engineer and Construction Record, and also in the above work.

Securing the contract for engineering and erecting the apparatus, the writer gave to it earnest study and attention, having constantly in view the results contemplated by the architect, Mr. George Pallisser—namely, a uniform temperature in all parts of the building and a constant change of air without perceptible draught. These results were obtained, and the official tests on exceptionally cold days were so satisfactory as to elicit from the architect a report to the board which was very flattering to the engineer.

But glory is a perishable article if intrusted to the keeping of the average school janitor. The first appointee of the board was a man possessed of good common sense, for, after wrestling with the problem of ventilation during one season and finding his abilities overrated in the appointment, he resigned, and was succeeded by one who had the recommendation of numberless best citizens. He took the position early in the summer, and matters ran smoothly with him till cold weather necessitated heat. For the sake of humanity (and the engineer) I sent word to him that it would be my pleasure to explain to him the working of the apparatus or send a man to start it, but he informed me that he had paid his predecessor five dollars to show him about it, and he guessed he could get along. Well, he did get along, and so did the complaints. Meeting him, I inquired how he succeeded.

"All right," he replied; "only send a man to fix one of them things that shuts off the water."

"What do you mean?"

"Why, there is two of 'em on every coil—one is for steam and one is for water, and this one turns round and round, and you might turn on it a week and do no good."

"Oh," I replied, "you mean one of the return-valves is out of order; probably the wheel is loose from the stem, or the disk is off. I will have it repaired."

Humanity and the engineer suggested that I had better go to the building and investigate matters generally. I found the temperature in the first-story hall about 100°, the heat rushing out through the ventilation registers, and the place just fit for an incubator. In fact, it did hatch an idea, and that was that the vent-shaft was closed, and so I called the janitor and mounted to the tower.

The door leading to the attic was wide open. I said: "Mr. Janitor, this should always be kept closed. It weakens the draught in your vent-shaft when open."

"I know it," he replied, "but I ain't touched it. It's just as Dan left it."

Looking further I found one of the dampers closed and the other two partly so. I said: "These dampers should be open when the apparatus is running."

"I know it, but I ain't been up here since Dan left, and he must have run 'em so all last winter."

An insatiable desire to tell the man something he did not know took possession of me, and so I went to one of the vacant class-rooms and on the blackboard drew a simple sketch of the apparatus, and traced the current from the cold-air duct to tower by arrows. I had barely finished before he remarked:

"I understand all that."

It was clear that here was a lucid delineator, an apt scholar, or a descendant of Ananias.

The next move was to the boiler-room. There was a roaring fire under one boiler. The gauge indicated fifteen pounds pressure. I remarked that it was not necessary to carry so high a pressure. The apparatus would circulate at any pressure.

"I know it, but sometimes she goes up, and then again she goes down; you can't keep her steady anywhere. The chimney ain't right."

One of my men fired this boiler for two weeks and found no trouble, and so I began an investigation. The difficulty was soon found. The damper-handle had worked off and had been replaced, but the wrong way, for when the pressure increased the regulator opened the damper, and *vice versa*. This was soon righted. I then observed that the gauge on the boiler not in use indicated fifteen pounds pressure. "Why is that, Mr. Janitor?" I asked.

"That's nothing but air," he replied; "it often does that."

Finding a pipe leading to the boiler quite hot, I inquired if the valves on the return from the coil in the ventilating-shaft were properly adjusted.

"Oh, yes; they are just as Dan used them—they are all right."

It required an ocular demonstration to convince him that they were all wrong, and that he was running the water of condensation to the cold boiler, for he persisted in his assertion until at my request he raised the safety-valve, and nearly lost his equilibrium in his effort to escape the blast of steam which followed. He concluded that he had been on the defensive long enough, and so he opened fire with :

"Say, Mr. Engineer, that pump you put here to take the water out of the coils has never worked once since I came."

"There is no pump here," I replied.

"Yes, there is ; this little one on the side of the boiler," said he, placing his hand on the injector.

"Have you tried to get the water out of the coils with this ?"

"Yes, but it don't work, and its no use to try to get the water back into the boiler ; that thing don't put it there. So to keep the coils from getting full I keep this cock open and let it run into the sewer."

I said this injector was not placed here for that purpose, but only for use in case of an emergency. "If, by any accident (?), such as occurred to your damper-regulator, the pressure should exceed the city water-pressure, and it should be necessary to feed, the injector would be serviceable. But it is not intended to work at low pressure, and there is no occasion for it. Further, the water of condensation in this apparatus will all return to the boilers by gravity if you will allow it to do so. You had better allow me to send my man here to straighten out matters for a day or two."

"Send him to fix that val, that's all I want of him. And there is another thing to fix : one of the little pipes in front of the coils that I open to let water out don't work ; he can do that at the same time."

"Let me see to what you refer," said I, and he led the way to the heating-chamber. "These are automatic air-valves. What do you do with them ?" I asked.

"I open 'em every night and shut 'em every morning, and I tell you it's a big job, for there's a lot of 'em."

This is not overdrawn ; it is all true, and the members of the board in charge have been advised. Here is an apparatus designed for and capable of securing all the comfort that can be obtained from an agreeable temperature and a pure air, costing a large sum of money, placed in charge of an ignorant, pretentious fellow. In his charge, in a basement under a school containing four hundred children and their teachers, are two horizontal tubular boilers, very safe in the hands of a capable, trustworthy man, but a very engine of destruction under certain conditions. Where will the responsibility rest if those conditions are developed ?

Surely Doctor Billings had such a case in mind when he wrote : "It should be remembered and impressed on the managers of public institutions that every system of heating and ventilating apparatus requires constant care as to its cleanliness, efficiency and adjustment to the demands of the season and the hour to produce the best results, and that the most wasteful of all expenditure is to provide an elaborate and costly apparatus and then intrust it to the care of an ignorant or careless engineer on the ground that he is somebody's 'nephew,' or is an active politician."

I only add that there is a possibility, if a serious accident should occur, the incarnation of ignorance responsible for it might be absent from the building and there would be denied the coroner the enjoyment of sitting on him, which is now the only resource of the

ENGINEER.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. II.

(Continued from page 139.)

SOIL-PIPES (CONTINUED).

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

24. What is the use of calking after the lead is poured in ?

To expand the lead, which contracts when it cools, and drive it into all the irregularities of the iron pipe, and so make a well calked joint.

25. What is the least depth the ring of lead formed by calking should have ?

1½ inches.

26. How can pipes be calked when in a recess of the wall ?

By leaving a joint loose here and there and turning the pipes around ; then, when necessary to do the final ones, see that ample room is provided to go all over them.

27. What is a rust joint ?

One made with iron filings or turnings welded with water and sal ammonia and sulphur. See receipt : Five pounds of iron filings free from oil, one ounce of sulphur and one ounce of sal ammonia ; mix thoroughly, with sufficient water to make a paste.

28. Is there any objection to its use ?

No serious one ; when well made it makes an excellent joint for certain cases and forms a continuous pipe. It is, however, impossible to separate them without breaking the pipe.

29. When is its use desirable ?

When cast-iron pipes are used for steam or hot water, the joints should be made very carefully in order to make them perfect, as in green-houses or in factories where exhaust steam is used.

30. How much lead should be allowed to a joint ?

One pound to each inch of diameter, as two pounds for 2-inch, three pounds for 3-inch, etc.

31. Why are putty, mortar, and cement, joints, objectionable ?

Because they are porous, brittle, and apt to crack and leak ; besides, mice eat putty ; all such joints are worthless.

32. What is the usual size of a soil-pipe in New York ?

Four inches ; in England they use frequently 3 and 3½ inch lead pipes.

33. Is there any advantage in having large soil-pipe ?

No ; consistently with the duty required the smaller the better, and 4-inch is the standard, except a large number of closets are on the same line.

34. Is it usual to make the horizontal drain-pipe in the cellar larger than the vertical soil-pipes ?

It is usual to make house-drain larger than the soil-pipe. The drain is generally 5-inch and 6-inch.

35. What proportion should the branch soil-pipe bear to the main drain-pipe, and why ?

The drain-pipe should be large enough to convey all that can be delivered to it by the branch-pipes.

36. How large should the soil-pipe be from the highest fixture to the roof ?

Should be same size all the way to roof ; soil and waste pipes should not be contracted, but, on the contrary, should be enlarged in cold climates at and above roof.

37. Should any allowance be made for the expansion and contraction of soil-pipes ?

It is not considered necessary, the expansion is so small.

38. What is the expansive power of cast-iron ?

It expands about one-eighth of an inch in 1,700 feet for each degree of temperature.

39. About how much would a stack of soil-pipe about fifty feet high be likely to expand and contract ?

It would expand one-seventh of one inch in fifty feet if the change of temperature be 40°, as from 40° to 80°.

40. Why should the hole in a wall through which a soil-pipe passes be larger than the pipe ?

To avoid the risk of the wall settling and thereby crushing the pipe.

41. What is the regulation of the Board of Health in regard to soil-pipes in cellars ?

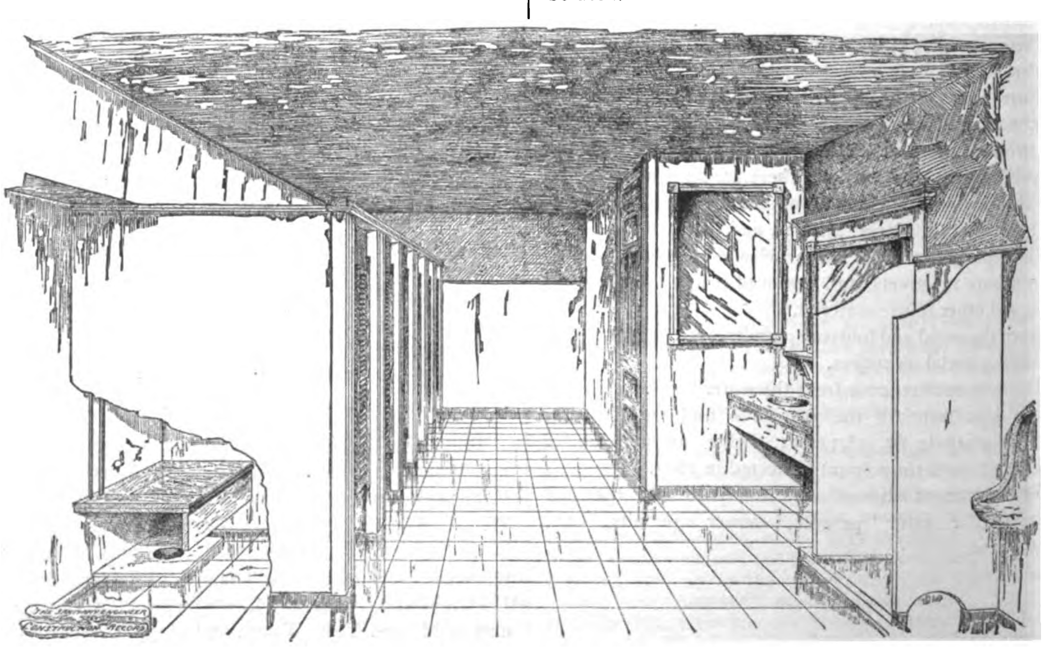
That it be hung on the wall or ceiling where practicable ; otherwise it must be laid in a trench, with the sides bricked up, with a movable cover. This, however, is not always insisted on.

(TO BE CONTINUED.)

TOILET-ROOM, ST. CLOUD HOTEL.

OUR illustration this week is a view of the toilet-room of the St. Cloud Hotel in New York. The room is in the basement, and the view is taken looking in from the windows on Broadway. There are eight water-closets, five urinals, and two wash-basins. The room is ceiled with white marble, with marble floor and partitions, the only wood-work being the doors and closet-seats. The only pipes visible are the supplies to the closet-cisterns and bowls, all of which are of brass, nickel-plated. With these exceptions the plumbing about the fixtures is set on the other side of the walls in adjoining rooms, making every pipe easy of access, and leaving the toilet-room clear of everything that could make cleaning difficult.

The master plumber was Thomas Corkoran, of this city.



ONE-PIPE SYSTEM AND ITS RELIEF-PIPES.

CORTLAND, N. Y., January 21, 1887.

SIR : Will you be so kind as to give us your opinion on the *one-pipe system and its relief-pipes* through the columns of your valuable paper and oblige a constant reader.

We have just completed a job of steam-heating in a private residence, wherein there are nine radiators or 500 feet of radiating surface, and while doing the job we had several visitors watching the work, and among them a man who thinks *he knows it all*, and who has made some trouble for us. We used the —— —— boiler, of Syracuse, and the job works good and heats the gentleman's house to 70° in zero weather. This man *who knows it all* went and told the party that had the work done that his piping was all wrong, and that we should have carried our return pipes overhead. Some friend of the owner has so worked on him that he thinks of having it done, and we have told him that we could prove what we had done was right and would leave it to you to decide. He has no fault to find with the heat and there is no noise or hammering, everything working quiet and the apparatus carrying only two pounds of steam in cold weather. He (this man who knows it all) says "there is no use of taking a relief from every radiator-pipe before we rise up to radiator." We have nine radiators and nine relief-pipes ; the latter dropped to the cellar bottom and carried back to boiler on floor, and on the main lines on each end we have a relief-pipe. All pipes pitch from the boiler. Relief-pipe only ¾ pipe. Now if you will give us your opinion in your next week's paper you will confer a great favor. Yours truly, K. & L.

[We cannot decide on the merits of any particular apparatus on *ex-parte* representation, or at least without having a faithful diagram of the apparatus presented to us for publication. On a principle, however, we are free to give our views. The questions here involved, if we understand our correspondent rightly, are : (1) Whether a relief-pipe from a *one*-pipe apparatus should be carried on the floor (and consequently below the water-line) or overhead ; and (2) whether a relief-pipe from every end is a detriment or not. Our reply to these questions cannot be other than (1) relief-pipes are best when dropped to the floor ; (2) it matters not how many relief-pipes are taken from mains if they all drop below the water-line, provided there is, at least, one for every low end of steam-pipe. A *third* question may be involved, which is, Whether the mains for a *one*-pipe system had better pitch *away* or *towards* the boiler ? Answer : In short mains they *may* pitch towards the boiler, but in long ones they *should* pitch away from it.]

A MILWAUKEE correspondent writes : "The plumbers of Milwaukee are very lucky, for, besides the ordinary wear and tear of plumbing, their friends, the rats, which gnaw the pipes, and Jack Frost, they now have found a new friend in the fish that are being pumped into the supply-pipes by the thousands and get in ferrules, stop-cocks, and closet-valves and shut off the supply to the buildings effectually. Sometimes these little fish make quite a job for the plumber, but, as a rule, they can be removed readily. In one instance, pebbles stopped the supply-pipe to a store three times in one week. Strainers of some kind ought to be used."

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
January 22.........	24.91	19.49	20.23	29.42	28.95	21.98	31.60

E. G. LOVE, Ph.D., *Gas Examiner.*

M. DE MERITENS states that if iron is subjected to the action of an electric current while immersed in a bath of cold water, a coating of the protoxide of iron is formed on the surface. If now it be placed in a solution of some metal, as copper, gold, silver, etc., the metal is deposited on the iron as a perfectly adherent layer.

THERE are nine large companies engaged in the manufacture of carbons in the United States. Seven of these have recently entered into a mutual agreement respecting the price of their wares, and have issued a joint circular to their customers. The prices agreed upon are quoted per 1,000 feet as follows: 7/16x12-inch at $12, ½x12-inch at $15, and ⅝x12-inch at $25; shorter lengths and odd sizes in proportion, plus a stated percentage.—*Electrician.*

IT has been decided to raise the price of gas in Birmingham 2*d.* per 1,000 cubic feet. This is done in preference to increasing the local taxes.

THE new gas-holder of the South Metropolitan Gas Company of London will have a diameter of 250 feet, a height of 174 feet, and an estimated capacity of 8,250,000 cubic feet.

COAL-GAS escaping from the stove in her bedroom suffocated a woman in Wilkesbarre, January 10.

ON January 3, an explosion of natural-gas nearly demolished a bank building in Youngstown, O. It had been escaping in the vault during the night, and ignited at the match of the book-keeper who entered the vault in the morning.

A NEW METHOD OF MAKING INCANDESCENT FILAMENTS.

THE Wollaston process of obtaining fine platinum wire consists, as is well known, in enclosing the wire, before the drawing process, within a thicker wire or tube, and after the drawing process, dissolving the silver off by nitric acid. We understand that Mr. Robert Dick, of Glasgow, has invented a somewhat analogous process in order to obtain fine and dense carbon filaments for his incandescent lamps. Mr. Dick has tried a variety of materials, such as silk, cotton, paper, etc., but finds the fibres of the kitool plant specially adapted to his purpose. (What kind of a vegetable is the kitool?) In using these fibres he draws them through fine steel draw-plates or dies with sharp cutting edges to a uniform size. The fibres so prepared are then enclosed in a fine copper tube, the fibre being much longer than the copper at this stage, to allow of the tube being drawn over the fibre. These tubes are then drawn down, which reduces their diameter and compresses the material within them to the desired density. The compressed tubes, with the filaments thus formed in them, are then cut into suitable lengths, and bent or shaped approximately to the desired form the carbons are intended to retain in the lamps, which admits of their being rolled into spirals or other shapes, in which state they are carbonized within the tubes under pressure by heating them to bright redness in a plumbago crucible in the ordinary way. After this carbonization of the filaments, the copper tube or other metallic coating is removed from the greater part of their length, or wholly removed by immersion in nitric acid, or by electrolysis. Part of the metallic coating may, however, be left at the ends to serve as convenient means of connecting the filaments to the conducting wires of the lamp. The employment of the metallic tube serves the purposes of compressing the material forming the filament placed within it, and of maintaining the pressure and shape during the carbonizing process. The advantages, according to Mr. Dick, obtained by this compression of the carbon-forming material during its formation and carbonization are many: First, it strengthens the filament mechanically; second, it enables the carbon to give a high specific amount of luminosity per unit of energy expended on it in the lamp, thus rendering the carbon filament a very durable and economical medium in incandescent lamps for electric-lighting.—*Electrician.*

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

EFFECT OF FREEZING ON THE TYPHOID GERM.

DR. JOHN S. BILLINGS, U. S. A., sends us the following:

It is well known that freezing water does not destroy the vitality of all living organisms contained in it, although it does appear to kill some of them. To settle the question as to the effect of freezing on the bacillus of typhoid, I have had the following experiment made:

January 10, 1887.—Five cubic centimetres of sterilized water in a test-tube was inoculated with typhoid bacillus and exposed to the outer air during the following night at a temperature of about 10° Fah. It was found solidly frozen in the morning.

January 11, 2 P. M.—This frozen mass was thawed, and from it there were inoculated three gelatin and one Agar tubes.

January 13, 10 A. M.—There is decided typical development of the typhoid bacillus in the Agar tube and in two of the gelatin tubes.

Evidently, therefore, the vitality of the typhoid bacillus is not destroyed by freezing.

J. S. BILLINGS, Surgeon, U. S. A.

DR. ALFRED CARPENTER, OF CROYDON, AND "THE SANITARY ENGINEER."

A FEW weeks since we received a letter from Dr. Alfred Carpenter, the Medical Officer of Health of Croydon, England. It was a personal attack on Mr. Henry C. Burdett, of London, provoked apparently because of some criticisms by Mr. Burdett of the plans of the sanatorium, at the Reedham Asylum, in his series of articles on "Cottage Hospital Construction," page 419, issue of September 30, 1886. We wrote Dr. Carpenter that the letter was unfit for publication, but told him if he would confine himself to the criticisms made by Mr. Burdett we would print such a communication. In reply to this we get the following, which we are willing to gratify the Doctor by publishing, especially as the strictures are mainly against ourselves:

DUPPAS HOUSE, CROYDON, January 4, 1887.

SIR: I am sorry to find that the Editor of THE SANITARY ENGINEER having slandered a promoter of sanitary work in this country refuses him the right of indignant denial. I looked for better things from an enlightened American. I can now only place you in the same category as your friend, whose action is to impede, not assist, progress, and to subscribe myself as

Your obedient servant,

ALFRED CARPENTER.

A BURNING EXPERIENCE.

ASBURY PARK, N. J., January 23, 1887.

SIR: For the benefit of other inspectors whose duty requires them to fumigate buildings, I wish to relate an incident which occurred a few days ago, and which may serve as a warning and perhaps prevent personal injury to some one. It is my usual custom to use alcohol to aid in the ignition of the brimstone, but on the occasion referred to no alcohol was at hand, and I thought kerosene oil might answer the purpose. I therefore broke up the sulphur and placed it in the pot as usual, the pot being placed upon bricks in a wash-tub in which was about two or three gallons of water. Half a pint of kerosene oil was poured over the broken sulphur and the oil was fired. I then left the room. An hour afterwards I returned to see if everything was progressing properly and I found the flames extinguished, and very little gas had been liberated. The sulphur had melted and a hard crust had formed upon its surface. I then obtained alcohol and proceeded to clean the pot of the hard mass. This proved difficult to accomplish, and a chisel and hammer were needed. After a few smart blows were struck the chisel suddenly passed through the crust, and a deluge of molten sulphur flew in my face and upon my clothing. It was like melted lead, and it burned like red-hot coals. This experiment teaches me that kerosene oil is not just the thing with which to start the burning of sulphur, and that there is no economy in trying to utilize molten sulphur.

PORTER L. LIPPINCOTT,
Assistant Inspector of B. of H. of Asbury Park, N. J.

THE New York County Medical Society wants all manure in New York City baled in the stables and shipped, to avoid the nuisance of the existing manure-dumps.

PROPOSING A SINGLE HEALTH COMMISSIONER FOR NEW YORK CITY.

THE following bill was introduced into the New York Legislature, January 25, 1887, by Senator Daly.

AN ACT IN REGARD TO THE HEALTH DEPARTMENT OF THE CITY OF NEW YORK.

The people of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION. 1. The existence of the Board of Health of the Health Department of the City of New York shall cease and determine upon the appointment and qualification of the Commissioner of Health provided for in this act.

SEC. 2. The head of the Health Department shall be called "Commissioner of Health," and shall hold office for six years, unless sooner removed, and until his successor shall have been appointed and shall have qualified. His annual salary shall be eight thousand dollars. He shall be appointed by the Mayor, and may also be removed by him, for reasons to be stated in writing and published in the *City Record*, which reasons shall not be questioned in any other place.

SEC. 3. The first commissioner appointed under the provisions of this act shall be appointed within ten days of its passage, and shall hold office until the first day of May, eighteen hundred and ninety-three, unless sooner removed.

SEC. 4. Except as otherwise provided in this act, the authority, duties, and powers of the said commissioner shall be in all respects the same as the authority, duties, and powers hitherto imposed upon and enjoyed by the said Board of Health.

SEC. 5. The said Commissioner of Health shall appoint and at his pleasure remove a Deputy Commissioner of Health, who shall, in addition to his other powers, possess every power and perform all and every duty belonging to the office of said commissioner, whenever so empowered by said commissioner by written authority, designating therein a period of time not extending beyond the period of three months nor beyond the term of office of the said Commissioner of Health during which said power and duty may be exercised; and such designation and authority shall be duly filed in and remain on record in the Health Department. The said Deputy Commissioner of Health shall possess the like authority in the case of the absence or disability of the Commissioner of Health. The said Deputy Commissioner of Health shall also possess all the authority and fulfill all the duties hitherto attached to the office of Secretary of the Board of Health, which office is hereby abolished. He shall receive an annual salary of five thousand dollars.

SEC. 6. The office of attorney and counsel to the Board of Health is hereby abolished. The counsel to the corporation shall assign an attorney to the Health Department, whose office shall be in the same building as the offices of the said department. The counsel to the corporation shall also appoint a sufficient number of clerks and other emyloyees to assist the said attorney. A sufficient amount of the appropriation for the Health Department for the year eighteen hundred and eighty-seven shall be transferred by the Board of Estimate and Apportionment to the credit of the law department to pay the salaries of the said attorney and the employees in his office.

SEC. 7. The sanitary code adopted and declared as such at a meeting of the Board of Health of the Health Department of the City of New York, held in the city on the second day of June, one thousand eight hundred and seventy-three, as amended in accordance with law, is hereby declared to be binding and in force in said city, and shall continue to be so binding and in force except as the same may from time to time be altered amended, or annulled by said commissioner. Said commissioner is hereby authorized and empowered from time to time to add to or to alter, amend or annul the said sanitary code, or any part thereof. He may therein publish additional provisions for the security of life and health in the City of New York, and distribute appropriate powers and duties to the employees of the department, not inconsistent with the constitution and laws of this State. It may embrace therein all matters and subjects to which and so far as the power and authority of said Commissioner of Health extends; not limiting their application to the subject of health only. But no such alteration or amendment shall take effect or be binding or in force until the same shall have been approved by the Mayor and shall have been published daily for two successive weeks in the *City Record*. The publication of additional provisions in and of additional ordinances of the sanitary code daily for two successive weeks in the *City Record* shall be sufficient and render any further publication of the same in any other newspaper unnecessary. Any violation of said code or its amendments shall be treated and punished as a misdemeanor, and the offender shall also be liable to pay a penalty of fifty dollars, to be recovered in a civil action in the name of the Health Department of the City of New York, before any justice or tribunal in said city, having jurisdiction of civil actions; and all such justices and tribunals shall take jurisdiction of such action. In all courts of justice or judicial proceedings, proof of the said sanitary code, and of the proceedings of the said Commissioner of Health and of the Mayor in relation thereto, by the production of the appropriate records of the Health Department, or a transcript of such records duly authenticated by the Commissioner or Deputy Commissioner of Health, shall be held and taken as complete and valid evidence of the said sanitary code, its due adoption, enactment, and publication.

SEC. 8. This act shall take effect immediately.

AN ARTESIAN WELL HARNESSED.

COLONEL NELSON TIFT, of Albany, Geo., has actually harnessed an artesian well and made of it a hewer of wood and drawer of water. A tank sixteen feet high, with a capacity of 6,000 gallons of water, has been constructed of heavy, durable timbers, into which the full flow of the well can be turned, which fills it in one hour. Under this tank is a substantial over-shot wheel about ten feet in diameter, the steel axles of which run in metallic boxes, firmly secured on a very heavy wooden frame. Upon this wheel the full force of the water from the tank can be thrown, and, with a fall of 200 gallons per minute, the speed and force is something marvelous. Connecting bolts run a circular saw about two feet in diameter, which cuts up the fire-wood. An old gin has been converted into a forage and oat cutter by filing off the teeth of the saws and converting the brush into a wooden drum, against which the sharpened steel disks cut. The oats and long forage are fed to it as cotton is fed to a gin, and is rapidly converted into the desired shape for feeding. A little brook flows over its pebbled bed through an orchard, comprising many fruit trees of great variety. At one point along the stream its flow can be turned into a channel by means of a gate that carries drinking-water for cattle into a wood pasture near by. The wandering stream empties into a beautiful artificial fish-pond, whose banks abound in shade and fruit trees, and upon whose placid bosom nestle eight little islands, fringed with osier willows, and upon which rose-bushes, Japan plum-trees, magnolias and other ornamental trees and shrubs grow in luxuriance.—*Baltimore Sun.*

TWELFTH ANNUAL REPORT OF THE SECRETARY OF THE STATE BOARD OF HEALTH OF MICHIGAN, for the fiscal year ending September 30, 1884. 303 pp., 8vo. Lansing. 1885.

This volume is a little behind time, but better late than never. The business report of the secretary, Dr. H. B. Baker, gives a summary of the proceedings at the business meetings of the board, the annual report of property, etc. It includes a series of replies from nineteen sanitarians and physicians to the question as to whether the presence of a large cemetery in a city is regarded as detrimental to public health. All the answers were in the affirmative, though two or three were not unqualifiedly and peremptorily so, and these last seem to us to be the wisest.

Following the secretary's report are eighteen papers, abstracts, and reports on various matters relating to public health. Among these the following are noteworthy:

(1) A report by Dr. H. F. Lyster on an outbreak of typhoid fever in a school at Adrian, Michigan. In this case the origin of the first case is doubtful. The others seem to have been caused by the use of water from a well which was polluted by the excreta of the first case.

(2) A brief paper on the purification of water by freezing, by Dr. C. P. Pengra, who reports the results of a series of experiments on the effects of freezing water upon the micro-organisms which it contains. Some of the bacteria appeared to be killed, but some survive the process, and as they multiply very rapidly, the destruction of a part of them makes little difference.

(3) A paper on the influence of sawdust on potable and culinary water in Michigan, by Dr. R. C. Kedzie. He says: "The sanitary problems that confront some of our manufacturing cities, where large quantities of lumber are made from pine logs, and where the difficulty of disposing of sawdust and mill-waste has led to the use of these materials for filling water-holes and low places, and made lands of large area are seen, begin to attract the attention of those interested in the public health. In some places large areas of low ground but little above the water-level of the adjacent lake or river have been built up with sawdust until sufficient elevation has been secured to build houses on these made lands. To such an extent have whole blocks and streets been built up with this saw-mill waste that the epithet 'sawdust city' applies with singular force to some of our most enterprising business centres. For centuries the world has pondered the problems of house-building when 'founded upon the rock,' or 'built upon the sand,' but now we have the additional improvidence of the man who built his house upon the sawdust. The whole question of the relation of large quantities of decomposing organic matter to the public health in its widest aspect—wooden pavements, wooden sidewalks, wooden curbing for wells, and wooden walls for cisterns and cellars, as well as those vast embankments which line our rivers, and the acres upon acres of marsh and swamp reclaimed for human habitation by a flood of sawdust that swamps the original flood—demands the careful consideration of the health authorities." His conclusion is that waters which have filtered through sawdust contain an amount of organic matter sufficient to condemn them for potable and culinary use, as they may at any time become dangerous by nourishing and reproducing the germs of epidemic disease.

(4) A carefully prepared paper by Dr. H. B. Baker on the relation of the depth of water in wells to the causation of typhoid fever. This paper was read before the American Public Health Association in 1884, and has been widely circulated. His general conclusion is that in Michigan typhoid fever follows low water in summer, and high water at that season of the year when the ground is usually thoroughly frozen, and that a large portion of the disease can be prevented by ceasing to drink contaminated water. "It *may* be that all that is necessary is to destroy and keep out of the water all discharges from persons suffering from typhoid fever; but the difficulty of recognizing the disease early enough in its course is so great, that in order to do this it will be necessary to keep all human excreta, and perhaps the excreta of some animals, out of the water-supply."

A large part of the volume is occupied with studies on the meteorology of the State and on the time of greatest prevalence of each disease, made by the secretary, Dr. Baker. These are illustrated with diagrams, and the data are given in a series of elaborate tables.

The whole report forms, like all those which have been made by Dr. Baker, an interesting and suggestive piece of work.

FROM the report of the sanitary state of the city of Montreal for 1885, by Dr. Louis Laberge, Health Officer, it appears that the estimated population of Montreal in 1885, including the municipality of Hochelaga, which was annexed to the city, was 167,501, of which 93,641 were French Canadians.

The proportion of deaths during the year per 1,000 living population was for the French Canadians 64.72, for other Catholics 29.60, and for the Protestant population 20.05. The great excess of mortality among the French Canadians is of course mainly due to the small-pox epidemic and to the neglect of, or opposition to, vaccination among that class of people. The total number of deaths from small-pox was 3,164, of which 2,887 were French Canadians.

The story of the epidemic is briefly and clearly told, and the mortality from it is illustrated by diagrams showing the proportion in the several wards, the number of deaths each week, etc., which are very instructive.

A striking illustration of the effects of vaccination is given by the Rev. Abbe Décarie from the municipality of St. Henri, near Montreal:

No. of cases of small-pox	233
No. of deaths	115
No. of unvaccinated among the deaths	115

That is, up to December 31, 1885, not one of those who died had been vaccinated. With the exception of two cases, not one child in St. Henri which had been successfully vaccinated took small-pox.

It is to be hoped that this report is the first of a long series of valuable municipal sanitary docunents.

IN presenting the ninth biennial report of the State Board of Health of California, the secretary of the board, Dr. G. G. Tyrrell, calls attention to the impossibility, under existing laws, of collecting trustworthy records of vital statistics for the State. The law requires that the County Recorders shall furnish to the Board of Health a record of the births, deaths, and marriages occurring in their respective counties, but this is practically a dead letter, since very few persons ever register births or deaths with the recorders, there being no special inducement for such action and no penalty for failure to register. Inquiry showed that in only eight of the cities or towns having organized boards of health was a permit required for burial.

Legislation was proposed to remedy this state of things by providing the payment of twenty-five cents for each birth, death, or marriage registered, and by imposing a penalty of fifty dollars for each failure to furnish the proper record, but the bill failed to become a law.

Legislation to effect a proper registration of vital statistics is what is most needed in the State, both as a means of putting its sanitary work on a proper basis and as a means of settling judicial questions relating to legitimacy and the inheritance of property, and it is to be hoped that a law which can, and will, be enforced, and which will secure this end will be passed by the next legislature.

Meantime all that can be said with regard to the healthfulness of the State is that during the past year there have been no epidemics of sufficient magnitude to command attention, and that it is probable that the mortality has not been above the average.

Following the report is the usual appendix of papers on various subjects which forms over half the volume.

It includes a brief but interesting paper by the President of the Board, Dr. H. S. Orme, on "the Climatology and Diseases of Southern California;" a "Report on the Topography, Botany, Climatology, and Diseases of Surprise and Goose Lake Valleys," by Dr. G. M. Kober, U. S. Army, and a paper on the "Coast Climate of California," by Dr. J. W. Robertson, all of which give useful data with regard to the climatology, but are weak as regards diseases for want of reliable statistics.

In addition to these there are papers on the "Drinking Habit in California," by Dr. W. H. Mays; on "Alcohol," by Dr. J. G. Jewell; on "Trichinosis," by Dr. A. Abrams; on "Yellow Fever considered in its relation to the State of California," by Dr. W. Nelson, who has had experience in the Isthmus of Panama, and gives a graphic brief sketch of some of the conditions there; and a reprint of the essay of Dr. Sternberg on "Disinfection." The volume as a whole is creditable to the board, and is calculated to educate the people and their legislators as to the needs of the State in sanitary organization and means for its support.

THE "Transactions of the Society of Medical Officers of Health (London) for 1885 is received. In addition to the usual business reports this volume contains the inaugural address of the President, Dr. W. H. Corfield, "On the history of house sanitation," and papers on "The cholera bacillus of Koch," by Dr. G. A. Heron; "On suction of sewer-gases into service-pipes conveying drinking-water a fertile causation of enteric fever," by Dr. H. Swete; "On the recommendations of the Royal Commission on the housing of the working classes as affecting the status of the Medical Officer of Health," by Dr. Edward Seaton; "On the protection of milk from contamination, and the measures necessary for maintaining the purity of milk supplied to the Metropolis and other towns," by Drs. A. Wynter Blyth and Alfred Spencer; "Regulations as to lodging-houses," by Dr. R. S. Lovett; "The sanitary condition of poor districts in the Metropolis, with especial reference to their water-closet accommodation," by Dr. Louis Parkes; "Dr. Koch's gelatin-peptone water-test," by Prof. G. Bischoff; and "On the waters derived from the Bagshot beds considered as drinking supplies," by W. Eassie, C. E.

All of these papers deal with important practical subjects, and, although some of them turn mainly on certain local legislation or regulations, all of them will be found interesting and suggestive to sanitarians on this side of the water.

DURING the last quarter of the present year there has been a great prevalence of infantile diarrhœa in Sheffield, England. Dr. Sinclair White, referring to it in his report to the Town Council, says that there is something more than season as a cause to consider, and he is convinced that the two additional causes which stand out most prominently are (1) improper feeding of infants, and (2) filth in its widest sense. The seasonal influence taken by itself does not cause epidemic diarrhœa, as has again and again been shown by contrasting neighboring towns where heat and rain have been alike, but where the diarrhœa mortality has been altogether different; and, as is stated in the report, it is clear that this seasonal influence can only be dangerous where other favorable predisposing causes are present. Remove these and seasonal influence is practically inoperative for mischief. As regards the question of infant feeding, it is suggested that the Health Committee might with great advantage cause to be drawn up and printed for wide distribution simple hints which would be helpful to mothers and others. The filth difficulty is a greater one in a large borough, where the almost ubiquitous midden is in many places a serious nuisance. In the more crowded parts of the town these antiquated receptacles for filth, with their seething contents, are referred to as giving off offensive gases which pollute the air of the badily ventilated courts; and it is precisely such an influence as this that the sensitive organization of childhood cannot withstand.—*From London Lancet.*

SOAP AND SANITATION IN JUDEA.

THE engineer and the soap-maker are penetrating regions in which they were never seen before, or in which their visits had left few and faint impressions. The picturesquely inconvenient and unclean cities of lower Italy have been visited by the Government inspector and the Government engineer, who have widened old streets, cleaned them and kept them clean.

Syria for a long time was untouched by progress and soap, but to-day there are signs that a change is going on that will puzzle the pious pilgrims of the next decade. There are glass windows in Jaffa; Beirout is beginning to look like a European seaport, and has a commerce giving employment to 400 steamers and 3,500 sailing vessels

yearly. Nablous—Shechem—where Joseph was sold, is the seat of flourishing manufactures. It sends shoes and soap all over Palestine. Bethlehem, we are told, is almost entirely rebuilt, and has clean streets, well paved and lighted. Cæsarea is reviving.

The Holy City itself is becoming clean and undergoing great changes. Some quarters are being rebuilt. There are street-lights in Jerusalem, and public clocks have been set up. Tanneries and slaughter-houses have been banished from the city proper. There is a system of sewerage under way. All these things work for the benefit of the people of Syria and travelers, and this consideration will mitigate the sorrow of those who will seek in vain in its cities for reminders of that past which made it to the world the Holy Land.—*Boston Transcript.*

CARLISLE WATER-WORKS.

SOME new filter-beds for the Corporation of Carlisle have been completed by Messrs. R. H. & H. Hodgson, of Workington, at a cost of about £8,700, and form part of the works of supply from the River Eden. The extensions have been made under Mr. J. Hepworth, C. E., and include a subsiding reservoir, having an area of 5,353 superficial yards, and a sand filter with an area of 2,401 superficial yards—the total area being about twice that of the old filter. The whole of the walls are of cement concrete, and the foundations are laid upon the rock for a considerable length, the remaining length being laid upon the gravel. The walls of the subsiding reservoir, which occupies the north end of the site, are 4 feet in thickness at the bottom, and 2 feet 6 inches at the top. The bottom of the bed is covered with Lazonby flags, having a fall from all sides towards the centre, where is fixed a 12-inch diameter pipe, by which all the water and sediment that may have deposited on the flags may be drawn off from the reservoir when it is required to be cleaned. The water is admitted from the river into the reservoir by a 24-inch valve placed in a culvert at the north end of the reservoir. The outlets from the reservoir to the sand filter are four in number, 12-inch diameter each, with valves attached, and are fixed at a height of about 2 feet above the level of the flags. The water in the new reservoir will have ample time to settle before passing through the sand filter. The walls of the sand filter are 4 feet 6 inches thick at the bottom, and 2 feet 6 inches at the top. The filtering material consists of six layers through which the water has to percolate. The first or bottom layer, which is bedded round and over the tunnels for conducting the water into the service reservoir, consists of a layer 15 inches in depth, of washed stones, from 4 to 8 inches in diameter; the second layer, 12 inches in depth, of a bed of stones 3 inches diameter; third, a bed of stones 1-inch diameter, laid 3 inches deep; fourth, a bed of stone ½-inch diameter, laid 3 inches deep; fifth, a layer of pebbles not more than ¼-inch diameter, laid 3 inches deep; and sixth, a layer of fine sand, 2 feet 6 inches deep. The water, after passing through the filtering media, is conducted into the old service reservoir. A new duplicate pumping-main, 14-inch diameter, has lately been laid from the pumping-station to Botchergate. The capacity of the new subsiding reservoir and of the filter is equal respectively to 298,000 and 131,000 gallons per foot in depth, or 1,330 and 580 tons. The daily consumption of water last year was 930,700 gallons, or equal to 4,150 tons; and the total quantity of water supplied last year was 339,729,000 gallons, or 1,516,600 tons. The supply of that quantity of water involves the filtration of a million gallons daily, and as these extensions will filter a million and a half gallons daily, the wants of Carlisle have been provided for for some years to come. The filter now completed is the third that has been constructed. Three filters in all have been constructed, and are now in existence at these works. The first, constructed in 1847, consists of perforated culverts and tiles laid under the bed of the river; and the water filtering through the superincumbent sand and gravel is conveyed from these culverts in pipes to the pumping-station. The engineer for this work was Mr. J. Simpson. The second filter was that constructed by the corporation in 1868, the engineer being Mr. John Melrose; and the third, constructed in 1886, and described above, the engineer being Mr. J. Hepworth.—*The Engineer, London.*

SALICYLIC ACID IN BEER.

THE *Archiv für Hygiene*, Volume V., Heft 4, contains a paper by Dr. K. B. Lehmann, of the Hygienic Institute of Munich, on the question as to whether the addition of salicylic acid to beer is liable to produce injury to health.

After pointing out that the literature of the subject consists almost entirely of assertions without evidence, he relates an experiment tried by himself on two laborers of Munich. From November 23, 1885, to February 21, 1886, each of these men drank daily half a litre of beer in which was mixed five cubic centimetres of a 10 per cent. solution of salicylic acid, thus taking a larger amount of the drug than would be contained in several pints of ordinary salicylized beer. Both men remained in perfect health, and Dr. Lehmann concludes, therefore, that salicylized beer is harmless.

A WRITER in the *Gesundheits Ingenieur* advocates the use of rust-joints for water and drain pipes instead of lead, on the ground of greater efficiency and economy.

He mentions, however, as a qualification of a good joint that it should be to a certain extent elastic, and permit variations due to settlement and heat or cold.

It does not appear that the proposed joint, which is excellent for certain places—bridge seats, for instance—would be satisfactorily elastic, but would, on the contrary, be excessively rigid, and any economy of joint material would be more than offset by the extra heavy bells required to stand the swelling which takes place in the rust in setting.

A FIRE on January 6 destroyed the iron foundry of E. P. Allis & Co., in Milwaukee, The loss is estimated at $250,000, and several hundred men are thrown out of employment. Mr. Allis will rebuild as soon as possible.

THE *Revue Industrielle* has lately given the results of a number of experiments made by MM. Durand-Claye and Debray, confirming the view previously expressed by M. Lechartier that the failure of cements by cracking after having set well in the first instance is almost always due to the presence of magnesia in greater or less quantity. This substance invariably causes the cement to swell where exposed to moisture, and the internal strains caused by this swelling eventually disintegrate the cement.

ENGINEERING NEWS.

OUR cotemporary, the *Engineering News*, announces in its last issue that Mr. A. M. Wellington, late "technical editor" of the *Railroad Gazette*, will hereafter be identified with it as a member of its editorial staff and as a "component part of the *Engineering News* Publishing Company." This accession to the editorial force of our cotemporary will, we anticipate, widen the scope of its efforts and make it more valuable to its readers. Our friends have our best wishes for their prosperity.

DR. HENRY C. BURDETT, whose name is well known to the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, is the editor of a new weekly journal, called *The Hospital*, several numbers of which we have received and examined with interest. It is the organ of the Hospitals Association, and is intended to be the means of intercommunication between the managers and officers of hospitals as well as to educate the people as to the needs and best modes of organizing and managing institutions for the relief of the sick. It is published at the low rate of a penny a number, or sixpence each for monthly parts. There is ample room for such a journal, and we wish it abundant success.

ERRATUM.

IN THE SANITARY ENGINEER AND CONSTRUCTION RECORD of January 15, 1887, page 157, the name of the architect who has been instrumental in promoting the Architects' Association should read George B. Ferry, whose address is 395 E. Water Street, Milwaukee, and not George Terry, as printed.

PERSONAL.

MR. CHARLES G. DARRACH, C. E., has became a partner in the firm of Wilson Brothers & Co., of Philadelphia.

MR. JOSEPH WAINWRIGHT, C. E., has reported on the value of the works and franchise of the Monongahela Navigation Works, to be forwarded to Congress.

MR. THOMAS H. DODGE, of Worcester, has given to the Natural History Society $1,000 for purchase of tents and erection of a summer pavilion for the society on Lake Quinngamond.

MAYOR G. W. GARDNER, of Cleveland, and members of the Board of Improvements are inspecting the methods in New York and other cities for laying underground electric conduits.

SAMUEL HANNAFORD, Harvey E. Hannaford, and Charles E. Hannaford under the title of Samuel Hannaford & Sons, of Cincinnati, is the present style of this well-known Cincinnati office.

MR. JOHN GUILFOYLE, contractor, has been appointed Superintendent of the Brooklyn Federal Building in place of Thomas B. Rutan, resigned.

GENERAL CHARLES P. STONE, engineer of the erection of the Bartholdi pedestal and statue, died in this city January 24. He graduated from West Point in 1845, saw service in the Mexican War and War of the Rebellion, and was one of those Americans who acquired rank and fame in Egypt.

THE death of John Roach, who was President of the Chalmers-Spence Co., of New York, left a vacancy, which was filled on the 24th inst. by the advancement of Robert H. Martin, the former Secretary and Business Manager. Mr. George E. Weed still holds the position of Treasurer, while Mr. Charles H. Van Nostrand has been made Secretary of the company.

THE Michigan Society of Civil Engineers met in Grand Rapids, January 25, 26, 27.

THE annual meeting of the Cincinnati, O., Master Plumbers' Association for the election of officers was held January 21. The old board was re-elected without exception, and remain as follows: President, Robert Carlisle, of the Thomas Gibson Co.; First Vice-President, Frederick Lamping; Second Vice-President, Col. W. S. Nock, of Covington, Ky.; Secretary, N. K. Aylward; Treasurer, Richard Murphy; Seargeant-at-Arms, Stephen Nolan. Messrs. Stephen Nolan, William Gibson, and Louis Felix were appointed a committee to make arrangements for the annual banquet, which takes place on the anniversary of the association, February 21.

Patents.

354,091. Pumping-Engine. William A. P. Bicknell, New York, assignor to William A. Perry and Charles C. Worthington, both of same place. Filed August 4, 1886. Issued December 14, 1886.

354,098. Tile-Machine. Daniel Brose and John Baumgartner New Washington, O. Filed November 20, 1885. Issued December 14, 1886.

354,099. Feed-Water Regulator. Frederic Cook and Burchard Thoens, New Orleans, La. Filed May 6, 1886. Issued December 14, 1886.

354,102. Machine for Butt-Welding Tubes. John Crea, Allegheny, Pa. Filed July 27, 1886. Issued December 14, 1886.

354,112. Hydraulic Method and Machinery. Nelson B. Eldred, Auburn, N. Y. Filed February 12, 1885. Issued December 14, 1886.

354,121. Mercurial Regulator for Dampers, etc. Richard J. Flinn, Boston, Mass., assignor, by direct and mesne assignments, to the Flinn Mercurial Regulator Company, Portland, Me. Filed April 17, 1886. Issued December 14, 1886.

354,124. Piston Water-Meter. George S. Follansbee, Boston, Mass. Filed July 31, 1886. Issued December 14, 1886.

354,132. Petroleum Gas-Burner. Adalbert Haesner, Munich Germany. Filed July 8, 1885. Issued December 14, 1886.

354,133. Overflow-Pipe for Water-Closets. Edward Hammann Brooklyn, assignor to the J. L. Mott Iron-Works, New York. Filed October 27, 1886. Issued December 14, 1886.

354,143. Filter. John W. Hyatt, Newark, N. J. Filed September 7, 1885. Renewed November 11, 1886. Issued December 14, 1886. Patented in England July 14, 1885, No. 8,527; in France July 14, 1885, No. 170,116; in Belgium July 14, 1885, No. 69,590; and in Italy July 14, 1885, No. 18,667.

354,148. Stop and Waste-Cock. John H. Johnson, Chicago, Ill. Filed July 1, 1886. Issued December 14, 1886.

354,161. Warm Fresh-Air Ventilator. Alexander McArthur, Aledo, Ill. Filed February 4, 1886. Issued December 14, 1886.

354,172. Sectional Steam-Generator. Frederick D. Althause, New York. Filed October 9, 1886. Issued December 14, 1886.

354,185. Apparatus for Manufacturing Illuminating and Heating Gas. Francis B. Forster, New York. Filed April 14, 1886. Issued December 14, 1886.

354,194. Feed-Water Heater. William Herd, Harrison, N. J. Filed April 5, 1886. Issued December 14, 1886.

354,197. Pipe-Wrench. John Leib, Sandy Run, Pa. Filed November 4, 1886. Issued December 14, 1886.

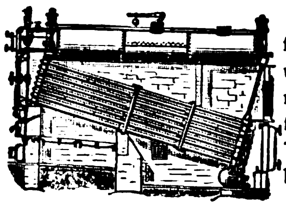
354,199. Drying Apparatus. John H. Lorimer, Philadelphia, Pa. Filed March 26, 1886. Issued December 14, 1886.

354,204. Adjustable Steam Flue-Cleaner. George G. McLaughlin, Boston, Mass. Filed May 3, 1886. Issued December 14, 1886.

354,216. Mold for Making Clay Pipes, etc. Charles A. Perry, New York, assignor to Gustavus W. Rader and Michael Schmidt, both of same place. Filed May 1, 1886. Issued December 14, 1886.

Steam and Hot-Water Heating.

"STEAM"



A valuable book for every steam user and engineer, published for FREE DISTRIBUTION by

THE

Babcock & Wilcox Co.,

MANUFACTURERS OF

WATER-TUBE BOILERS,

107 HOPE ST., GLASGOW.
30 CORTLANDT ST., NEW YORK.

Branch Offices:
BOSTON, 65 Oliver St. CHICAGO, 64 S. Canal St.
PHILADELPHIA, 32 N. 5th St.
NEW ORLEANS, 57 Carondelet St.
PITTSBURG, Room 64, Lewis Biluding.
HAVANA, CUBA, 50 San Igncio.
SAN FRANCISCO Hinckley, Spiers & Hayes, 561 Mission St

Jno. D. Ripley, *Sec'y & Treas.* A. W. Benedict, *Pres.* John B. Hughes, *Vice-Pres.*

St. Louis Steam-Heating
AND
Ventilating Company,

Contractors for Heating by most approved Methods Stores, Residences, Churches, and all Public Buildings. Plans, Specifications, and Estimates furnished.
No. 901 N. Main Street, ST. LOUIS.

EDWARD E. GOLD & CO.,
Bridge Store No. 6, N. E. Cor. Frankfort and Cliff Sts.
Manufacturers of
GOLD'S COMPOUND COIL HEATERS
The only direct heater by which Heat can be regulated without use of Valves.
SEND FOR ILLUSTRATED CATALOGUE.

LEBOSQUET BROS.
STEAM HEATING
APPARATUS
Combining the Latest Improvements.
HEATING PRIVATE RESIDENCES A SPECIALTY.
Send for Descriptive Pamphlet.
LEBOSQUET BROS., 75 Union St., Boston.

THE DAVIS STANDARD AUTOMATIC AIR-VALVE is used by all leading steam-fitters in the United States and Europe, for direct and indirect radiators. All first-class jobbers keep them. HAY & PRENTICE CO., Manufacturers, CHICAGO.

PHILADELPHIA, PA.
ORLANDO KELSEY,
STEAM-HEATING,
510 ARCH STREET.

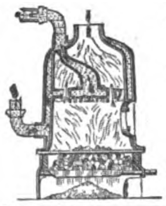
Steam-Heating.
GILLIS & GEOGHEGAN,
No. 116 WOOSTER STREET,
Above Spring, 3 blocks west of Broadway.

BARRON & McKENDRICK,
STEAM-HEATING,
100 WALKER STREET, NEW YORK.

THE OSBORNE SYSTEM OF STEAM-HEATING is based upon scientific principles carefully worked out and reduced to practice, having been in use for the last seven years; in short, it is an ideal system of steam-heating, adapted for use in all large buildings requiring steam heat. It is from 15 to 20 per cent. more efficient than the Gravity System, and from 30 to 40 per cent. more efficient than any of the Expansion or High-Pressure Systems using traps and open tanks.

For further information apply to
E. F. OSBORNE, M. E.,
ST. PAUL, MINN.

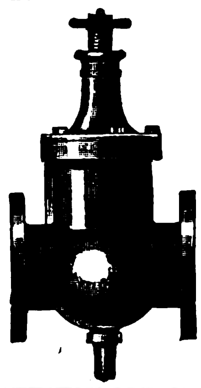
GREEN-HOUSE
Heating & Ventilating
Boilers for Heating Water for Baths.
HITCHINGS & CO.,
233 MERCER STREET, NEW YORK.
Send 4 cents postage for Illustrated Catalogue



Hot-Water Boilers,
FOR
GREEN-HOUSES,
BATHS, ETC.
JNO. A. SCOLLAY,
74 and 76 Myrtle Ave., Brooklyn.
Catalogue sent on application

HOT-WATER BOILERS
FOR
HEATING DWELLINGS,
GREEN-HOUSES, ETC.
THOS. W. WEATHERED,
46-48 Marion St., N. Y.
Send for Illustrated Catalogue.

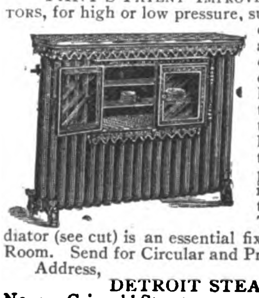
BUFFALO FORGE CO.,
MANUFACTURERS OF THE
"BUFFALO"
Blowers, Exhausters, Steam-Fans,
Exhaust Ventilating-Wheels and Hot-Blast Apparatus. Special Attention given to Warming and Ventilating Buildings, and all purposes where BLOWERS and EXHAUSTERS are used.
C. HENDRY, Consulting Engineer, BUFFALO, N. Y



CURTIS
Pressure
Regulator
FOR
STEAM, WATER AND AIR.
Curtis Regulator Co.
40 Beverly St., Boston, Mass.

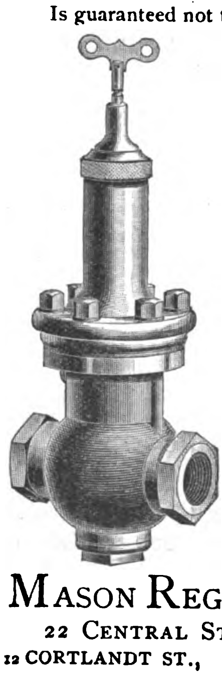
GENERAL AGENCIES
109 Liberty St., New York.
66 N. 4th St., Phila.
108 5th Av., Chicago.
210 S. 3d St., Minneapolis.
707 Market St., St. Louis.

THE DETROIT STEAM RADIATOR COMPANY'S PATENT IMPROVED CAST-IRON RADIATORS, for high or low pressure, superior to all in beauty of design and finish, and in efficiency of operation, being so constructed that steam having once entered the Radiator must pass through the entire length of each section, thus securing the most perfect circulation, and immediate heating of the whole Radiator. The Dining-Room Radiator (see cut) is an essential fixture in every Dining-Room. Send for Circular and Price-List.



Address,
DETROIT STEAM RADIATOR CO.
No. 129 Griswold Street,
Detroit, Mich.

OUR NEW
Reducing-Valve
Is guaranteed not to "CHATTER,"



And will reduce steam pressure as low as one pound.

Thirty days' trial allowed.

USED BY
Buerkel & Co.
Eureka Steam-Heating Co.
Martin Car-Heater Co.
Adams & Co.
Standard Sugar Refinery.
Franklin Sugar Refinery.
Baltelle & Renwick,
Porter Mfg. Co.

MASON REGULATOR CO.,
22 CENTRAL STREET, BOSTON.
12 CORTLANDT ST., NEW YORK.

NOW READY! PRICE, $3.00, POSTAGE PAID

STEAM-HEATING PROBLEMS;
OR,
Questions, Answers, and Descriptions
RELATING TO
STEAM-HEATING AND STEAM-FITTING,
FROM
THE SANITARY ENGINEER.
With One Hundred and Nine Illustrations.

PREFACE.

THE SANITARY ENGINEER, while devoted to Engineering, Architecture, Construction, and Sanitation, has always made a special feature of its departments of Steam and Hot-Water Heating, in which a great variety of questions has been answered and descriptions of the work in various buildings have been given. The favor with which a recent publication from this office, entitled "Plumbing and House-Drainage Problems," has been received suggested the publication of "STEAM-HEATING PROBLEMS," which, though dealing with another branch of industry, is similar in character. It consists of a selection from the pages of THE SANITARY ENGINEER of questions and answers, besides comments on various problems met with in the designing and construction of steam-heating apparatus, and descriptions of steam-heating work in notable buildings.

It is hoped that this book will prove useful to those who design, construct, and have the charge of steam-heating apparatus.

CONTENTS:

Address, BOOK DEPARTMENT, THE SANITARY ENGINEER,
82 and 84 Fulton Street, New York.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by Henry C. Meyer, in the Office of the Librarian of Congress at Washington, D. C.

Volume 15. Number 10. Published every Saturday.

NEW YORK, FEBRUARY 5, 1887.
LONDON, FEBRUARY 19, 1887.

Single Copies, Ten Cents. Subscription, $4.00 per year in advance, post paid. In America
Single Copies, Sixpence. Subscription, 20s. per annum in advance, post paid. In Great Britain.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* Henry C. Meyer, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

92 & 93 Fleet St., London.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of The Sanitary Engineer and Construction Record (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A Brockhaus, Esq., Querstrasse 29, Leipzic, Germany, and Asher & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to The Sanitary Engineer and Construction Record.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

BRIDGES OVER NAVIGABLE STREAMS.

In our issue of January 15, we called the attention of our readers to the glaring inconsistency between the action of Congress in the case of the Arthur Kill and the Delaware River. In the *one* case voting to allow a serious obstruction to be placed in a stream naturally none too wide for the immense traffic passing through it, and in the other voting a large sum of money to remove natural obstructions and give a channel as wide as the Arthur Kill channel has been made by nature—the traffic in the case of the Delaware being no larger than that through the Kill, if as large.

In continuation of the argument for the untrammeled use of our natural water-courses, we would refer to a report made in October last to the Cincinnati Chamber of Commerce by a special committee on the new Ohio bridge at that place, of which we herewith give an abstract. The report first refers to the immense and rapidly increasing commerce of the river and the low rates at which freight is carried. It then mentions the action of Congress, which in 1870 required a report to be made by three U. S. engineers as to "whether, in their opinion, such bridges, or any of them now constructed, or proposed to be constructed, do or will interfere with the free and safe navigation of said river, and if they do or will so interfere, to report also what extent of span and elevation above water will be required to prevent obstruction to navigation."

The board, as appointed, consisted of Major-General G. K. Warren, Major-General G. Weitzel, and Colonel William E. Merrill. They reported a law respecting bridges over the Ohio River which they believed to be "reasonable and just," and to require "no more of bridge companies than is absolutely essential for the preservation of the rights of navigation." A law was passed by Congress in 1872 substantially as recommended by this board, and it was accepted by all interests as a finality to all disputations about the construction of bridges across the Ohio. Under it three large bridges have already been constructed—the Henderson Bridge being the last; and to show that the requirements of the law were not too stringent, one steamer has already lost her chimneys at the Henderson Bridge and another was detained forty-eight hours at one time.

It is *now* proposed by two railroads to build bridges which shall not comply with the law—one by the Illinois Central at Cairo, and one by the Chesapeake and Ohio at Cincinnati; and, if the building be allowed, it will be, besides an outrage, an act of injustice to those roads which have complied with the law, and will set a precedent towards the destruction of the navigation of one of the most important rivers of the world, and a river on which large sums have been expended for the purpose of aiding and increasing the very commerce which will be destroyed.

The same tactics are being pursued by the railroads there as are being and have been pursued here respecting the Arthur Kill bridge. In fact railroad magnates seem to be utterly *incapable* of looking at water-borne transportation in any other light than as a thing to be destroyed as quickly as possible by either fair means or foul. Agents of the companies are putting forth inaccurate statements made in derogation of the commerce of the Ohio. For example, that the Illinois Central road carried more tons of freight across the river at Cairo than passed that point on the river. The facts are that in the whole of the year 1885 the railroad on the whole 2,066 miles operated by it—branches and all—as stated in "Poor's Manual," carried but 3,587,270 tons, while Pittsburg alone sends out annually by river 4,000,000 tons of coal, and about 1,000,000 tons of other freight are received and shipped from that city.

The bridge advocates would have it believed, also, that business on the river is declining, whereas the *increase* between 1878 and 1885 was thirty-six per cent. in tonnage capacity of steamboats plying on the river, or from 897,596 tons to 1,098,365 tons. The business done by the barge line between St. Louis and New Orleans may be taken as a fair sample of the increase of business on Western rivers. Its increase in tons of freight handled, comparing 1873 and 1884, is 138 per cent. The usual time occupied by the boats of the latter line from St. Louis to New Orleans is six days for 1,250 miles, while the railroad time for freight trains, 750 miles between the same points, is four days. The rate charged for freight by the barge line in 1884 was $2.37 per ton, while that by rail at the same time was $4.40, or *only* 85 per cent. more.

Coal is transported from Louisville to New Orleans, 1,500 miles, for $1 per ton, or at the rate of but one-fifteenth of a cent per ton per mile. The lowest cut rate by rail on any railroad route in the Union ever published is three times this amount, and the average rate on twenty-one of the leading roads of the United States for the year 1885 was 11½ times as great.

On the 18th of April last the steamboat "J. B. Williams" took out from Louisville to New Orleans a tow of 28,695 tons of coal. This, if loaded on cars, would have made a train fourteen miles long.

Mr. Fink shows by tables that the through rates for freight from Chicago to New York are practically determined by the competition of the waterways during about eight months of the year, and the Ohio River if unobstructed does the same for the great valley which it drains. *Ice* only obstructs the river about one month of the year, but a *low bridge* is a permanent obstruction.

The last point made by the report is that the claim made by the Illinois road—that *they* are unaided by Government, while the boatmen have a free river and the wealth of Government to improve it—comes with poor grace from a road the entire cost of building which was virtually defrayed by a land grant. As an element of inestimable importance to the State we may *well* say, God save the waterways!

THE CAISSON DISEASE.

The peculiar effects of exposure to increased, and especially to a sudden diminution from increased, pressure of the atmosphere on the human body are of especial interest to engineers and contractors who undertake constructions which require the use of air-tight caissons to keep out water, quicksands, etc., and in which the men work under an increased pressure of the atmosphere maintained by condensing air-pumps.

The effects of mere increased atmospheric pressure upon the health and comfort of the workmen are usually not great or serious. No doubt excessive pressures would produce grave results. In small animals, such as dogs and cats,

a pressure of from eight to twelve atmospheres will produce death, apparently, by causing an excessive absorption of oxygen by the blood. With the pressures used in air-tight caisson-work the chief inconvenience produced by mere increase of pressure is due to the difference in pressure of the air surrounding the man's head from that of the air contained in closed cavities connected with the air-passages, and especially the cavity of the middle ear lying behind the drum of the ear. This cavity communicates with that of the mouth by a tube called the eustachian tube, which tube is usually closed, but is opened by the action of swallowing. When this tube is closed excess of pressure of air on the external surface of the drum will force it inward, causing pain and sometimes rupture of the membrane, with resulting inflammation. In like manner pain may be produced in the upper jaw if the opening between the large cavity in that bone known as the antrum and the cavity of the nose becomes obstructed. All workmen should be warned not to go into the lock through which they pass into the compressed air unless they find that on blowing the nose forcibly there is a sense of pressure in each ear, showing that the eustachian tubes are open or can be opened. When these are clear the act of swallowing repeated a few times will equalize the pressure and relieve discomfort. If a man finds that either of his eustachian tubes are obstructed he should have the stoppage removed by having air forced through it from the nose, which had better be done by a physician.

What is known as the "caisson disease" is not produced by the mere increase of atmospheric pressure, but by the sudden diminution of it on leaving the caisson, which produces ruptures of small blood-vessels in various tissues. The first symptoms are usually acute pain coming on suddenly, beginning often in the knees. The workmen speak of these as "cramps," but there is really no cramp or muscular spasm. Sometimes there will follow congestion of the brain, and the man will stagger as if drunk. The main source of trouble, however, is in the spinal cord, producing paralysis, usually of the lower half of the body. The sensations of pain may continue in a leg which is entirely insensible to pricking or pinching. In fatal cases profound sleep usually precedes death. Recovery from the paralysis may occur, but often only after the lapse of several years.

The most frequent cause of this trouble is the too rapid "locking out"—that is, the not allowing sufficient time to gradually equalize the pressure of the air-lock with that of the outer air. The men are, of course, impatient to get out, and some of them will urge that the escape-cocks shall be opened wider. The rule should be that for each additional atmosphere of pressure six minutes should be allowed in locking out. Stout and heavy men are most likely to suffer and should not be employed if others can be had. No man having heart or lung disease should be employed in this kind of work, and it will pay to have all workmen examined by a competent physician before they are taken on. After the men come out of the lock they should not have to make much exertion, such as climbing long ladders, etc. For this reason it is much better for the men that the air-lock should be at the top, instead of at the bottom, of the shaft. They should never enter the caisson with empty stomachs, and they must avoid the use of alcoholic drinks. They should have extra clothing to put on when they come out of the lock. By taking these few and comparatively simple precautions, and especially by insisting on and enforcing the gradual diminution of pressure in locking out, increasing the time in proportion to the pressure, the dangers of caisson-work may be greatly diminished, and much suffering, delay, and expense avoided.

THE U. S. Senate has a bill before it providing that after June 30, 1887, the price of gas shall be uniform in all parts of the District of Columbia, and authorizing the Georgetown Gas-light Company to consolidate with the Washington Gas-light Company.

OUR BRITISH CORRESPONDENCE.

Artesian Wells for London—Electricity for Small Powers in Manufactories and Dwellings—Petroleum from Baku.

LONDON, January 19, 1887.

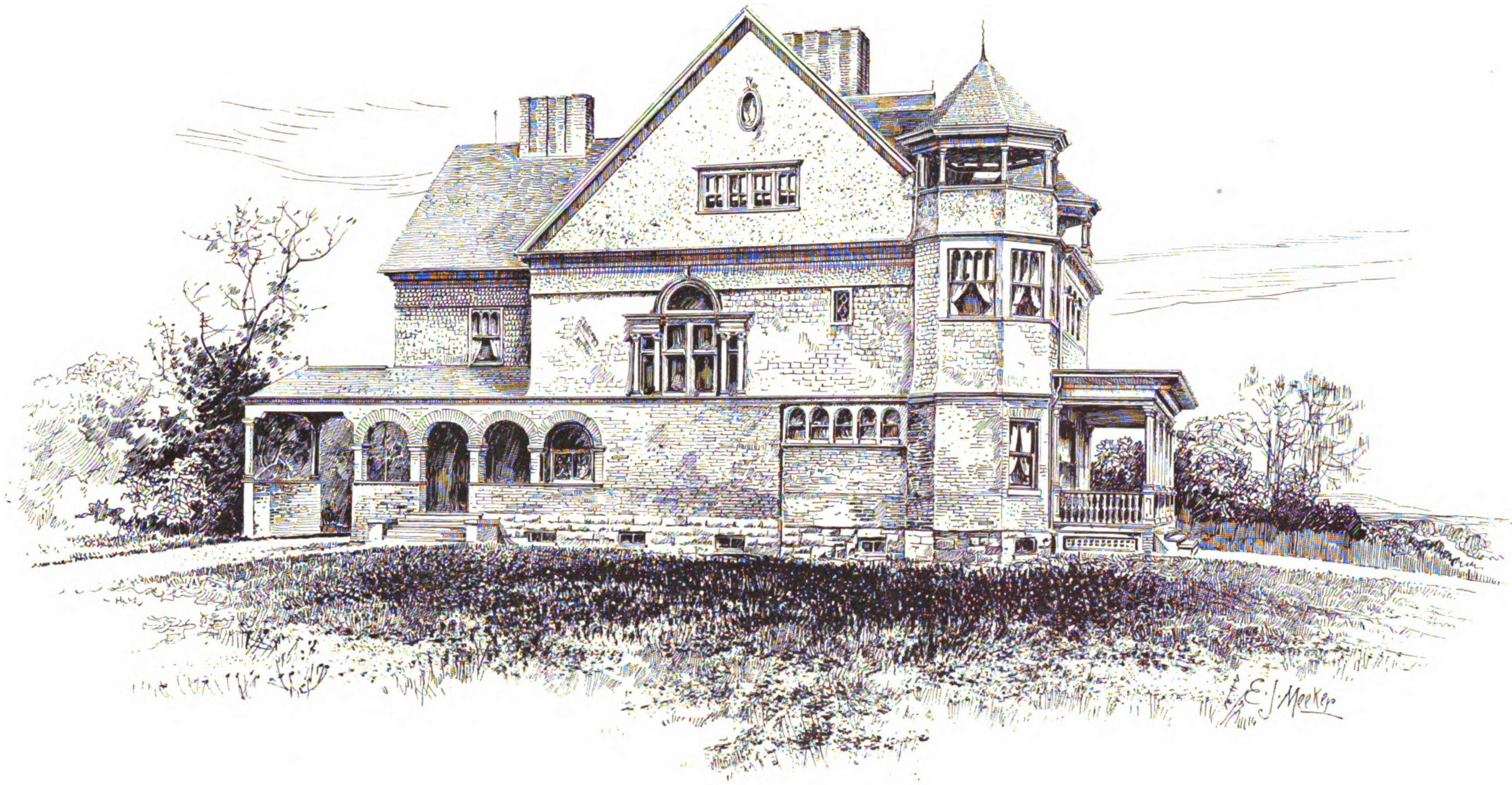
THE Commissioners of Sewers of the city of London have referred back to their special committee the report with regard to the sinking of artesian wells within the confines of the city, in order to supply the citizens with water. The suggestions of the report are to be carried out. There will, therefore, be a tube-well sunk in the neighborhood of the Artisans' Dwellings in St. Luke's to a depth of 400 feet and at a cost of £2,000. It was pointed out in the discussion that, although the ratable value of the city is twice that of twenty years ago, there is only one-half the consumption of water, owing to the citizens living away from their places of business. Notwithstanding the fact that the water-rate is an "ad valorem" *charge on the ratable value*, and that so much less water is used, the water companies have created this stir against themselves by their constant increase in charge, which is, in many instances five times what it was twenty years ago. It is estimated that the charge for water from the well will be *2d.* (4 cents) per 1,000 gallons. It is a pity that the system of charging by meter is not developed.

I hear that the owners of the Westminster Chambers property are about to sink an artesan well, with a view of supplying their tenants. The water companies, therefore, will be assailed at both ends of the town.

There is a company established under the title of the Union Electrical Power and Light Company, with the object of sending out batteries of electrical energy for use in manufactories and light installations in dwelling-houses. The cells which are to be charged and sent out by the company are lined with celluloid, and are 11 inches long by 6 inches wide by 7 inches deep, weighing about 20 pounds. They each contain six peroxide plates and seven spongy lead plates. The capacity for each cell is estimated at about 100 ampere hours.

Now that the question of petroleum for fuel is receiving such attention, the Baku Springs, situated in Belakhan

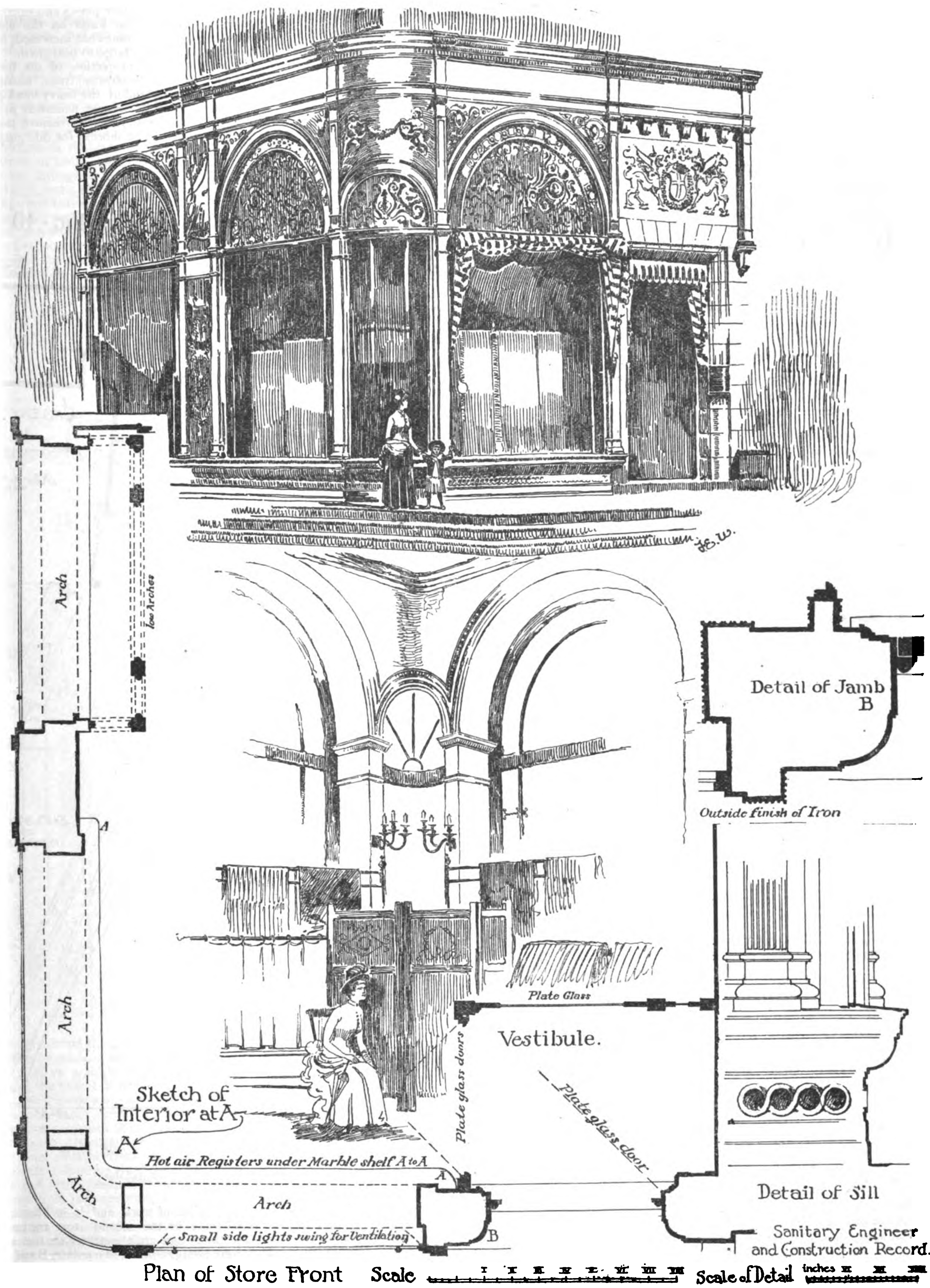
A COTTAGE AT WAHDURST, SUSSEX, ENG.—A. CROFT, ARCHITECT.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCE OF JOHN A. ADAMS, ESQ., CROCUS HILL, ST. PAUL, MINN.

GILBERT & TAYLOR, ARCHITECTS.


Arch
Arch
Arch
Arch
Arches
Sketch of
Interior at A
A
A
Hot air Registers under Marble shelf A to A
Small side lights swing for Ventilation
B
Plate Glass
Vestibule.
Plate glass doors
Plate glass door
Detail of Jamb
B
Outside finish of Iron
Detail of Sill
Sanitary Engineer
and Construction Record.
Plan of Store Front
Scale
Scale of Detail
inches

and Surakhane, will receive additional impetus. The flames from the gas that escape from the earth have existed for some generations. There are about 100 wells already sunk, and about the same number of refineries at Baku. The methods of extraction are according to American principles. Some of the best springs rise to a height of 200 feet, and yield 200,000 gallons. The oil only gives some 30 per cent. of lamping oil. It has been found that by mixing raw produce with a certain proportion of distilled petroleum the luminous power is greatly increased.

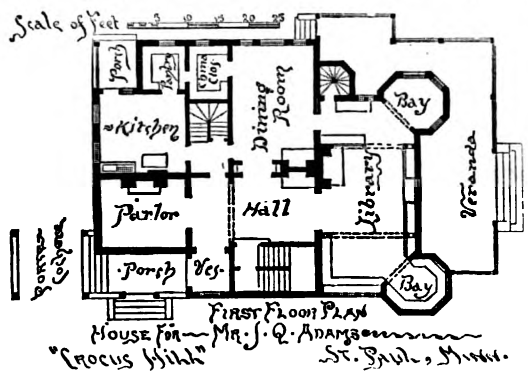
SAFETY VALVE.

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

A RESIDENCE AT ST. PAUL, MINN.—GILBERT & TAYLOR, ARCHITECTS.

THE subject of our special illustration this week is a residence located on "Crocus Hill," St. Paul, Minn., and owned by Mr. John A. Adams. The house was erected at a cost of $15,000. The material used in the construction of the first story is brick and timber, the second story is of



frame, shingled. The gables are of rough-cast plaster and shingles. The main hall is finished in oak and California redwood, the library in oak and Georgia pine, the dining-room in oak, the parlor in pine, with white and gold enamel finish. Messrs. Gilbert & Taylor, of St. Paul, were the architects.

A STORE FRONT.

ON page 231 we show the front of the store of Messrs. Beck & Co., paper-hanging manufacturers, on Fifth Avenue in New York City. The architects were Messrs. J. C. Cady & Co., of New York.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A COTTAGE AT WADHURST, SUSSEX, ENG.—A. CROFT, ARCHITECT, LONDON.

THE subject of our vignette illustration this week is a cottage in South Park, Wadhurst, Sussex, England. The architect was Mr. A. Croft, of London.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. X.

(Continued from page 207.)

FOR the purpose of illustrating the magnitude of the work on the Equitable Building, we give in Fig. 40 a plan of (what was called in the old building) the gallery floor, really the third story of the building. The outlines of the building before alteration are shown by dotted lines. It will be seen that there was an L giving an entrance on Pine Street, and the main entrance was on Broadway, about forty feet from Cedar Street.

By the purchase of additional property there is now a frontage of 167½ feet, extending from Cedar to Pine Streets on Broadway, fronts on Pine and Cedar Streets each of 224 feet, and a narrow front of 46½ feet on Nassau Street. By this means it is possible to have in the new building a magnificent passageway 308 feet long on the first floor from Broadway to Nassau Street, intersected by a like passageway between Cedar and Pine Streets. These open out into a grand court in the interior 100 feet long, forty-four feet wide and thirty feet high. "Marble columns, resting on a tesselated pavement, support the arched roof of marble and decorated glass." The grand entrance and hallway are twenty-two feet wide. These arcades will be lined with a great number of small shops, representing selected branches of business to meet the needs of the tenants of the building, such as stationery, medicines, theatre tickets, fruit, cigar, and confectionery stands, barber shop, baths, railway tickets, etc., etc.

The building covers nearly an acre of ground "There are nine steel boilers in the basement, with a combined capacity of nine hundred horse-power (the largest in use in any building in the world), with a power sufficient to force seventy-five hundred gallons of water a minute to the top of the building. These with other pumps in connection with the great tanks on the roof, and with the hose and other appliances for extinguishing fires, will render the building a safeguard to the surrounding property. An engine of four hundred horse-power will furnish the power for electric-lights."

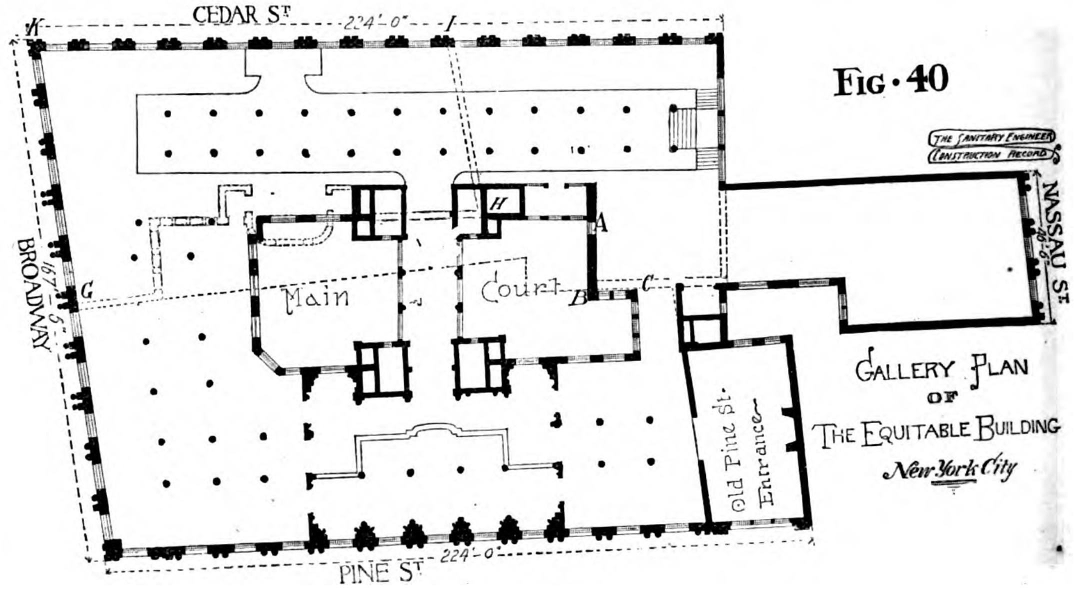
"There will be ten hydraulic passenger-elevators, which can be run from the ground floor to the eighth story in one minute."

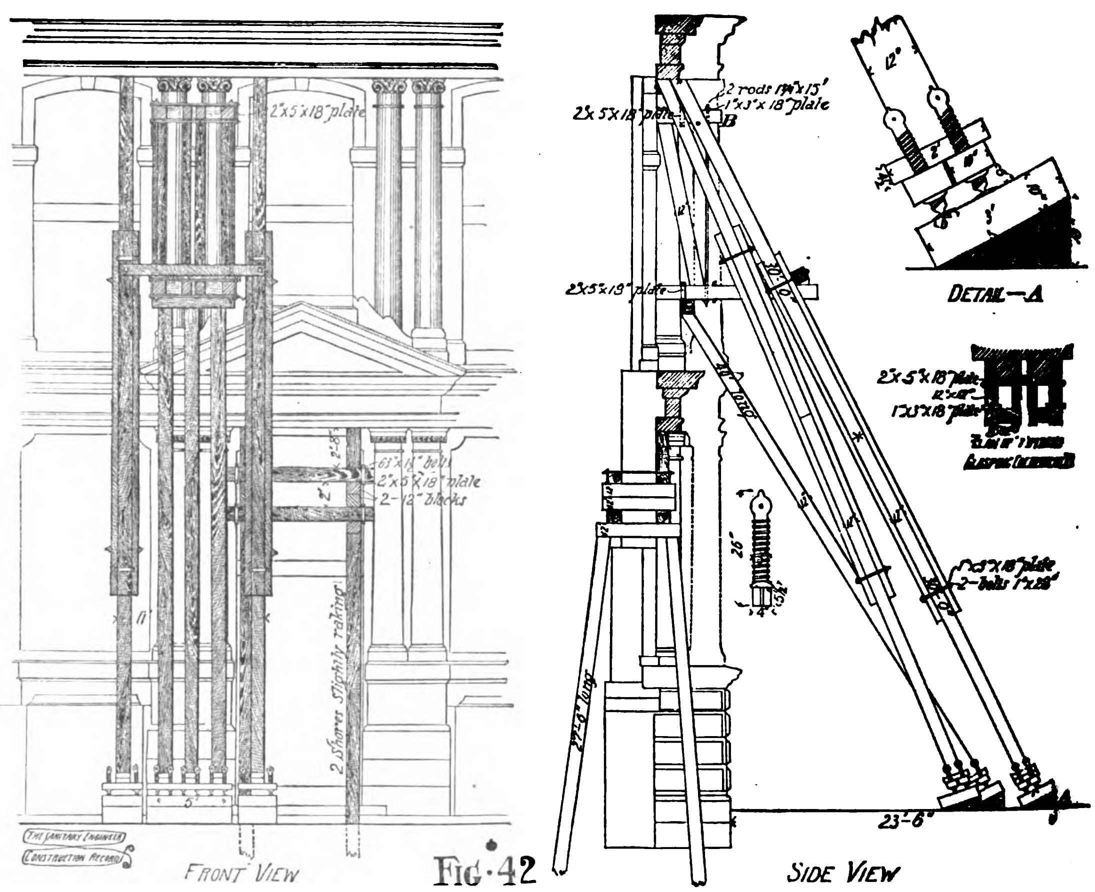
It is claimed that the building is fire-proof, as "every improvement in modern architecture which experience of the past shows to be advantageous has been adopted to render the building absolutely secure against fire" from any source.

All the façades are of granite. The height of the cornice to the old building on the street was ninety-four feet and of the new 110 feet. The height of the new deck cornice is 142 feet, and the height to top of the square tower over the centre of the Broadway front is 172 feet.

To avoid increasing the load on the foundations of the piers on the Cedar Street side, the portion added to the front was shaped in copper plates and filled in with hollow terra-cotta blocks. The loads on the old piers of the Broadway front were somewhat increased, but the foundations were abundantly large to bear them.

On account of the projection of the fourth pier from the corner on the Broadway front, having columns in the lower story, instead of the heavy block-granite courses of the other piers, it became necessary in the change of plans to shore it up and entirely remove the granite-work in the first story. The shoring for this purpose was a very interesting piece of work, and it is illustrated in Fig. 42. The columns in the second story are two feet in diameter, and their tops are about fifty-six feet above the curb. They were each grasped at two points, B and A, by two 8x12-inch Georgia pine blocks, hollowed out to fit. The detail is shown at the right of the plate. Examination will show that when the horizontal bolts, which are two inches in diameter and five feet long, are tightened, the result of the scissors-like arrangement of the clamps and blocks is to bring a powerful pressure on the columns, and the friction *alone* was relied upon to sustain the weight. It will be seen that four short timbers act as struts between the lower and upper sets, and the outer ends of the upper sets are held down by two 1¾"x13' bolts, transmitting the strain to the lower set. The outer end of the lower set bears against a timber spiked to the two 60-foot





• METHOD OF HOLDING COLUMNS BY FRICTION • THE EQUITABLE BUILDING ·N·Y·

shores either side of the pier. These 60-foot shores are each made up of two 12"x12"x30' sticks, spliced on all four faces by 3x12-inch planks, held at four points in both directions (the drawing shows but two) by 1x3x18-inch washer-plates and inch bolts. Just behind these are two other shores nearly as long, and all four bear under the cornice above the second story. Three other shores of the same size, about forty feet long, bear under the inner ends of the lower clasping timbers. Each one of the seven shores has under it four 26x3-inch jack-screws, taking their bearing on blocking on the granite pavement, and all were securely tied together by bracing so as to act as one.

The total load to be supported was about 165 tons, or about 6 tons on each screw. It was calculated that each clamp was capable of sustaining 36 tons, or that 144 tons could be supported by friction alone. The jamb-stones in the old doorway were supported by friction as shown. Two pairs of 12x12-inch timbers reaching across the doorway, were clamped at each end to the jambs by 1½x63-inch bolts passing through 2x5x18-inch washer-plates; 12x12-inch blockings, were placed between the pairs of clamps, and bearing-pieces also under the lower set for transmitting the load to the shores.

When all was ready the load was lifted by working all the supporting screws simultaneously until by sounding with a hammer on the masonry below it became evident that the shores were carrying the weight.

The advantage of this method over that by "needling"

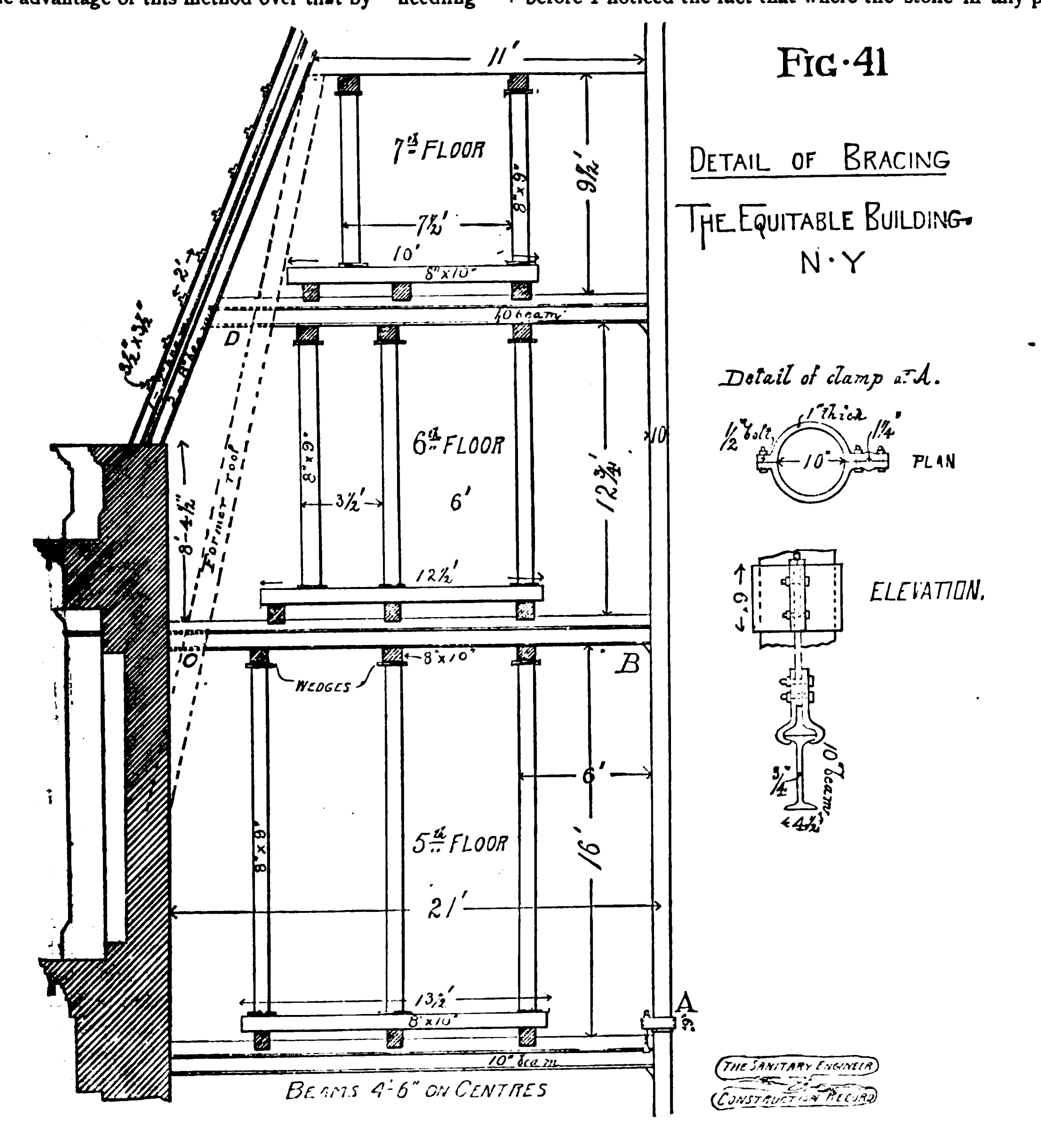


FIG. 41. DETAIL OF BRACING THE EQUITABLE BUILDING N.Y

was, that it preserved the granite-work intact, and allowed close joints to be made in replacing the work with new.

Figure 41 shows another interesting piece of shoring. In increasing the height of the building it became necessary to remove the mansard roof, but the iron floor-beams of the upper floors were supported at their outer ends by the iron rafters of the mansard. The load of two floors was therefore transmitted to the next below by shoring. The inner ends of these beams were supported by cast lugs on the columns. It will be seen that by this arrangement the load transmitted to the inner lug of the lower column from the supporting floor was very considerably increased, and it was not thought prudent to rely upon it. Advantage was therefore taken of a flange on the columns for attaching above them supporting clamps from which the inner ends or the lower beams were in part suspended by rods as shown in the figure.

(To be continued.)

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

In the years 1858-59, I had occasion to pass several months in the city of Rodez, the capital and also the cathedral town of the Deparment of Aveyron, in France. The cathedral was on the line of the Huguenot wars. It showed in every part the mistaken zeal of those religionists, much of whose energy was expended in destroying what was most beautiful. The main doors were a succession of diminishing arches lined with beautifully carved figures of saints in high relief, but every projecting piece that could be reached had been battered with a hammer, so that there was not a head, a leg, or an arm left on the hundreds of figures that formerly ornamented these doors. The cathedral foundations were laid in the eighth century. The building was finished in the last. It is constructed of red sandstone, very like the stone so much used in this city, and is the most prominent building in the vicinity. I had not passed it many times before I noticed that the stone of which it was built was subject to serious decay. It was not long before my attention was attracted to the fact that while the lower part of the church, which was completed previous to the fifteenth or sixteenth century, had the moldings and carvings which were left by the Huguenots perfectly sharp; all of the upper part, which was finished later, was almost a ruin. This was all the more remarkable, because the upper part was completed at a time when what might be called geometrical architecture was the fashion. There were geometrical staircases on every hand, staircases within staircases, lanterns supported on flying buttresses, and almost every other architectural puzzle that was in vogue in those days. It was not long before I noticed the fact that where the stone in any part of the building had a siliceous binding material, neither the moldings nor the surface of the stone were decomposed; but in proportion as the siliceous binding material decreased in quantity, so also was the stone decomposed, until some parts of the church had actually fallen from decay, and others were in danger. Having occasion to pass the cathedral almost every day for four or five months during different years, I became greatly interested in the study of the decomposition that was taking place in the stone composing it, as also in all the other varieties used in the vicinity. Being obliged to return to America in the year 1860, I noticed the same process of decomposition going on in some of the brownstones of this city, and began to make some experiments with a view of arresting the decay, some of which were so successful that the building on which they were made had the progress of its decomposition almost entirely arrested, and it would have remained so for some years to come, if the front had not been taken down for alterations two years ago.

In the year 1878, I noticed that the stone of which Trinity Church, in this city, is built, showed serious signs of decay. In the year 1880 it became necessary to undertake a thorough investigation of the causes of this decay, in the hope of learning some means of checking it. The work was placed in my hands. As the examination could not but be a difficult one, I commenced it by making a careful study of all those parts of the church where the stone was decomposed. The fact became evident that in almost every place where decomposition had begun, it was immediately under a projecting piece which produced surfaces more or less horizontal. It was apparent that at least a part of the decay was due to a defect in the construction of the moldings themselves, none of them being properly undercut, so that they do not shed rain as they should. In one or two instances imperfect stone was used in the construction of the church, and in a very few places decomposition has been caused by the position occupied by the stone itself. These studies of the stone in place, and of its decomposition, lasted through several months. I examined the stone inside and outside of the church, as far as it was accessible, high up into the steeple, and became aware that there were used in its construction four different kinds of stone, and that the rate of decomposition was likely to be different in each.

After learning what these varieties of stone were, and the mode of decomposition of each, I selected for examination thirty specimens from all parts of the building, both inside and out, some of which were pieces apparently fresh, and others were scales of more or less thickness, which were easily separated from the stone. A careful physical, chemical, and microscopical examination was made of all these specimens. As the investigation was somewhat extended, and involved the complete review of the whole subject of the decay of building material, and as what has been supposed to be one of the most permanent building-stones of New York and other cities, is undergoing the same decay as other stones in this country, I obtained the permission of the corporation of Trinity Church to publish my results. I have thought that it would be of interest to present to this society a short review of the whole subject of the decay of building-stone, as well as the investigation of the condition of this particular building. The matter is of all the greater interest at the present time, as not only some of the public buildings, but also monuments, which were designed to last for centuries, are, after only a very few years, showing serious signs of decay.

When we take into consideration what may be found in the air of cities, it is not at all surprising that stones which contain any soluble material should have this soluble portion dissolved in the course of time. The air of any large city may contain carbonic acid, nitric acid, muriatic acid, several different varieties of organic acids, ozone, and ammonia. On making some experiments to ascertain the effect of solutions of carbonic acid dissolved in minute quantities in water, it was found that 1.428 parts of a saturated solution of carbonic acid in water were required to dissolve one part of carbonate of lime at 32° F.; at 48° F. it required only 1.136 parts of acid. At a much higher temperature a considerably larger quantity of lime was dissolved. It was also found that dolomite was not so readily soluble in solutions containing carbonic acid as carbonate of lime. One part of artificial carbonate of magnesia is soluble in 150 to 300 parts of carbonic acid. The mineral magnesite is soluble in 5.071 parts of pure water at 55° F., with no carbonic acid in it. Artificial carbonate of magnesia, containing three equivalents of water, is soluble in 48 parts. It is also a well-known fact that concentrated solutions dissolve proportionately less than very dilute ones. Carbonic acid is found in the purest air to the extent of about $\frac{3}{100}$ of one per cent., and in the air of large cities to three times that amount. It is therefore not at all wonderful that this action of solution should take place in building-stone. It is known that nitric acid is generated in small quantities by lightning, and that muriatic acid is frequently found, to the amount of from 1 to 1½ grains to the gallon of air, in localities situated near manufactories or near the sea. Organic acids are sometimes found in the air in considerable quantities; and recent researches* have proved that these organic acids will attack minerals which are completely insoluble in ordinary acids, so that it has been proposed to substitute them entirely for the mineral acids in geological work; this is, perhaps, one of the reasons why the silicates in rocks are so easily absorbed by the plants, and will probably account for the ease of decomposition of minerals contained in the rocks which gelatinize with acids, and also for a considerable amount of the decomposition in the pyroxene and amphibole series.

Messrs. Spring and Roland have recently communicated to the Belgian Academy a series of observations made upon the amount of carbonic acid contained in the atmosphere during a year. They give the result of 266 determinations made in the city of Liege, Belgium; on one side of which there is an industrial, on the other an agricultural district. The average amount of carbonic acid obtained in 10,000 parts of air was 5.1258 parts by weight and 3.3526 parts by volume. These gentlemen remark that this is more than the amount contained in the air of Paris, which is 4.831 parts by weight and 3.168 by volume. The larger amount at Liege is owing not only to the large iron-works there, but also to the fact that the city is surrounded by coal mines. To this the authors attribute the greater heat of the city, as it is well known that a small quantity of carbonic acid in the air causes the absorption and prevents the radiation of heat. They also attribute the cold weather of May to the diminution of the carbonic acid caused by the absorption of it by the growing leaves. Their observations show that a fall of snow will increase the amount to 3.761 by volume, and that in cloudy weather the amount was 3.571 parts, and that there was always a larger amount in winter than in summer. They also found that the quantity was diminished by high winds, but increased with a high barometer; all of which researches go to show that at the very time when the stone is most likely to be acted upon unfavorably—that is, in the winter—there is the greatest amount of carbonic acid in the air. In Liege there are

* A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

*Annals New York Academy Science, Vol. I., p. 1.

some examples of the decomposition caused by the effect of gases as striking as any that can be seen anywhere in Europe.

The quantity of coal that is burned in the city of New York every year amounts to 4,500,000 tons. If we estimate that this coal contains, on an average, one-half of one per cent. of sulphur, which is an extremely low estimate, this would amount to about 35 pounds of ordinary sulphuric acid per ton of coal consumed, discharged into the air from the oxidation of the sulphur, and would amount in the course of a year to 78,750 tons of sulphuric acid. In this part of the country we burn anthracite, which gives off little else than carbonic acid, carbonic oxide, and sulphur. But in regions where bituminous coal is used, ammoniacal constituents are given off as well, and these are corrosive. In order to ascertain how much sulphuric acid could be collected from the rainfall of the city, a funnel and bottle were placed outside the window of the Metallurgical Laboratory of the School of Mines.* The funnel had an opening of 50 square centimetres. It was left exposed during 41 days. At the end of that time it contained 65 cubic centimetres of water. This water was found to contain 4½ milligrams of sulphuric acid. The experiment was not made with a view to catch all the sulphuric acid, but to see if some could be caught. Very many of the days were bright, and the quantity of acid-gas thrown into the air must therefore have been many times that amount, although the quantity is very large and sufficiently accounts for the rapid decay going on in the brownstone of that building. It has been estimated that the value of a London winter's smoke, including the carbon which is lost, as well as the other materials volatilized with it, amounts to $25,000,000.

It does not appear that ordinary salt contained in the sea-air, or even a considerable amount of sea-spray, has any very deleterious effect upon stone-work, except in so far as it produces a certain amount of other alkaline substances by the action of the salt upon other bases, and in this way becomes, like all other dampness, an agent of decomposition. Almost the only effect of it observable on buildings is its attack on tin roofing, which requires a protection of paint near the sea, while in the interior of the country it will last for years without rusting. A very interesting paper, giving the results of observations made near the city on the quantity of chlorides contained in our rainfall in the year 1884, has been recently published.† It is of great interest in this connection as showing that rain-water may be a fertilizing as well as a very destructive agent.

It may be said, as a general rule, that stones are less valuable as they are more porous, for the reason that they are more likely to absorb water containing the gases which attack the ingredients, and also because the water absorbed in freezing, by its expansion tends to disintegrate the stone. It has been said that the act of freezing is equivalent to the blow of a 10-ton hammer on every square inch of surface. Whether this be so or not, the continued expansion and contraction of a porous stone is quite sufficient to disintegrate it, and this disintegration will be all the greater as the stone contains more water. Stones that have already begun to decompose absorb a much larger quantity of water than those which are fresh from the quarry, independent of the quarry-water which they contain, and hence the decay will be more rapid as it progresses. Professor Wigner, who examined the obelisk on the Thames embankment, found that the weathered surface of the obelisk absorbed six times the amount of water that was absorbed by the stone which had suffered no decomposition. This, of itself, though small in amount, would be sufficient, in a climate like ours, to produce serious disintegration in the stone.

The builders of the early centuries seem to have understood the injurious action of water, whether as rain, hail, or snow, upon their buildings better than we do. Nothing is more striking than the shape of the lintels and sills of their great buildings, which are put in with a sharp incline downward. The architecture of these buildings was carefully studied, even in the minutest detail, and this is not at all strange, since these early masons and builders were a religious fraternity, who studied everything carefully, intending that their monuments, which are mostly churches, should be built to last for ages.

It is very interesting in the history of a country to trace the effects of the building material which its people are in the habit of using, upon their methods of construction. In this country we began with wood, because that was the cheapest material and the most easily obtained. The forms that were adapted to wood, our architects have carried into stone, which is entirely unsuited for them, and hence the constant recurrence of flat surfaces, which retain the moisture and precipitate decomposition, which otherwise might be very slow. It is true that the old Dutch settlers here constructed their roofs to some extent with reference to the great quantity of snow which is the usual accompaniment of the winters of this climate; but their successors have everywhere adopted flat surfaces. It is not generally supposed that these are more deleterious to the stone in countries where there is snow and ice than rain is in a country where there is only rain, but this is the fact; for where snow is allowed to lodge, the water running through it will concentrate beneath on the surface of the stone, and even when the snow above is not melted, if there is any thawing at all, the snow will be constantly moist on the bottom against the stone. This moisture percolates through the stone. The decomposition under projecting window-sills and on the lower side of balconies from this cause can be noticed everywhere throughout our cities.

(TO BE CONTINUED.)

* This experiment was made by Mr. J. B. Mackintosh.

† School of Mines Quarterly, Vol. VI., p. 35.

THE NEW CROTON AQUEDUCT.

No. XII.

(Continued from page 566, Vol. XIV.)

THE AQUEDUCT COMMISSION MONUMENTS.

THE system of monuments adopted by Mr. B. S. Church, the Chief Engineer, for the purpose of fixing in a permanent manner the grade and alignment of the New Aqueduct, appears to be superior to any now in use in this vicinity.

If monuments with similar dimensions had been set for locating the property lines in New York, the litigation which frequently occurs between the owners of real estate would be reduced to a minimum.

The bench-marks are illustrated in Figs. 1 to 3. Where the bench is to be set in earth a pit is dug 4 feet square and 5 feet deep, the centre of which is filled with concrete as shown in plan by Fig. 1, and in section at *b b*, Fig. 2. In the centre of this concrete the iron bolt *e* is set. This bolt is 4 feet 6 inches long, exclusive of the head, and one inch in diameter; the top being convex and set 6 inches above the natural surface of ground. A washer, for the purpose of making its position more secure, is shown in plan at *g*, and its position on the bolt by the section at *f*. The remaining space *c c* surrounding the concrete is filled with small stones and earth thoroughly rammed; but for the space between the concrete and broken lines, stone is principally used. The portion of the concrete extending above the natural surface is banked with solidly rammed earth which extends about two feet outside of this bed of concrete, as shown at *d d*.

Figure 3 is a section of an iron bolt used wherever necessary to secure a bench-mark in rock. A hole is first

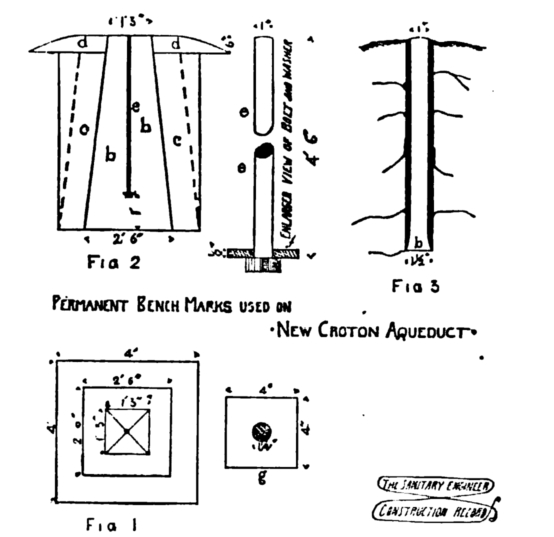


FIG 2 FIG 3

PERMANENT BENCH MARKS USED ON ·NEW CROTON AQUEDUCT·

FIG 1

drilled about 1½ inches in diameter, the bolt inserted and secured in position by a filling of brimstone, as shown by the heavy black lines. This bolt is one inch in diameter, with a convex top, and from 12 to 18 inches long, the length being controlled by the character of the rock. The lower end at *b* is upset 1½ inches to make its position secure after the brimstone filling is put in place.

For fixing alignment in earth, a granite monument is used, as represented in projection by Fig. 4. This monument is 6 feet in length, with a base 12 inches square, and top 6 inches square, and into the latter a copper bolt is inserted as shown at *a*.

Figure 5 is a detailed section of the top. The copper bolt *d* is 1 inch in diameter, 6 inches long, and convex on top, the lower end *c* being upset about 1½ inches. This bolt is secured in position with a filling of brimstone, shown by heavy black lines. The top of the monument is beveled and fine-axed, the sides are fine-axed for three inches below top; the remaining position is left hammer-dressed.

Figure 6 is a section of a monument in position. A pit is excavated 4 feet square and 5 feet 9 inches deep, into which this monument is set, and the remaining space surrounding it at *d d* and *e e* is filled with small stones and earth thoroughly rammed up to the natural surface, leaving the monument projecting three inches above; but the space *d d* is principally filled with small stones.

Figure 7 represents a section of a copper bolt used to secure alignment in rock. This bolt (*f*) is 1 inch in diameter, with a convex top and about 7 inches long, also upset at lower end. After the hole is drilled and the bolt inserted, it is secured in position by a filling of brimstone, as represented by heavy black lines. Where very soft rock is met with a longer bolt may be required.

We include this description in this series of articles since the scheme has evidently been well thought out: and the matter is a thoroughly practical one on which the latest practice should be made known.

(TO BE CONTINUED.)

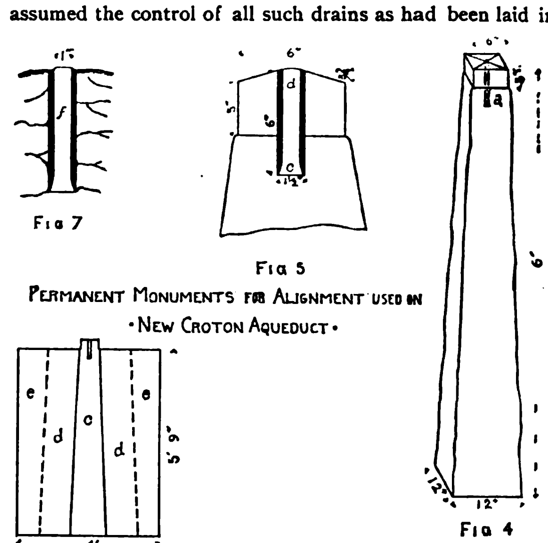


FIG 7 FIG 5

PERMANENT MONUMENTS FOR ALIGNMENT USED ON ·NEW CROTON AQUEDUCT·

FIG 6 FIG 4

MODERN SEWER CONSTRUCTION AND SEWAGE DISPOSAL.

BY EDWARD S. PHILBRICK, MEM. AM. SOC. C. E.

No. III.

(Continued from page 111.)

BY way of illustration of what has been said heretofore and further discussion of the work of construction in detail, it is now proposed to consider some works recently constructed, giving the reasons which influenced the decision of those in charge, resulting in the methods actually followed.

The first case to be taken up will be that of the recently constructed main drainage-works of the city of Boston, Mass., in describing which frequent use will be be made of the account published by the city in 1885, written by E. C. Clarke, Esq., the principal assistant engineer in charge of the construction.

Boston first became a city in 1823. Previous to this date the town had been provided with many miles of sewers by private enterprise, the owners of real estate having severally constructed various drains at their own expense, radiating in all directions from the tops of the hills to tide-water, without unity of design and with such skill as each builder could command when the need arose.

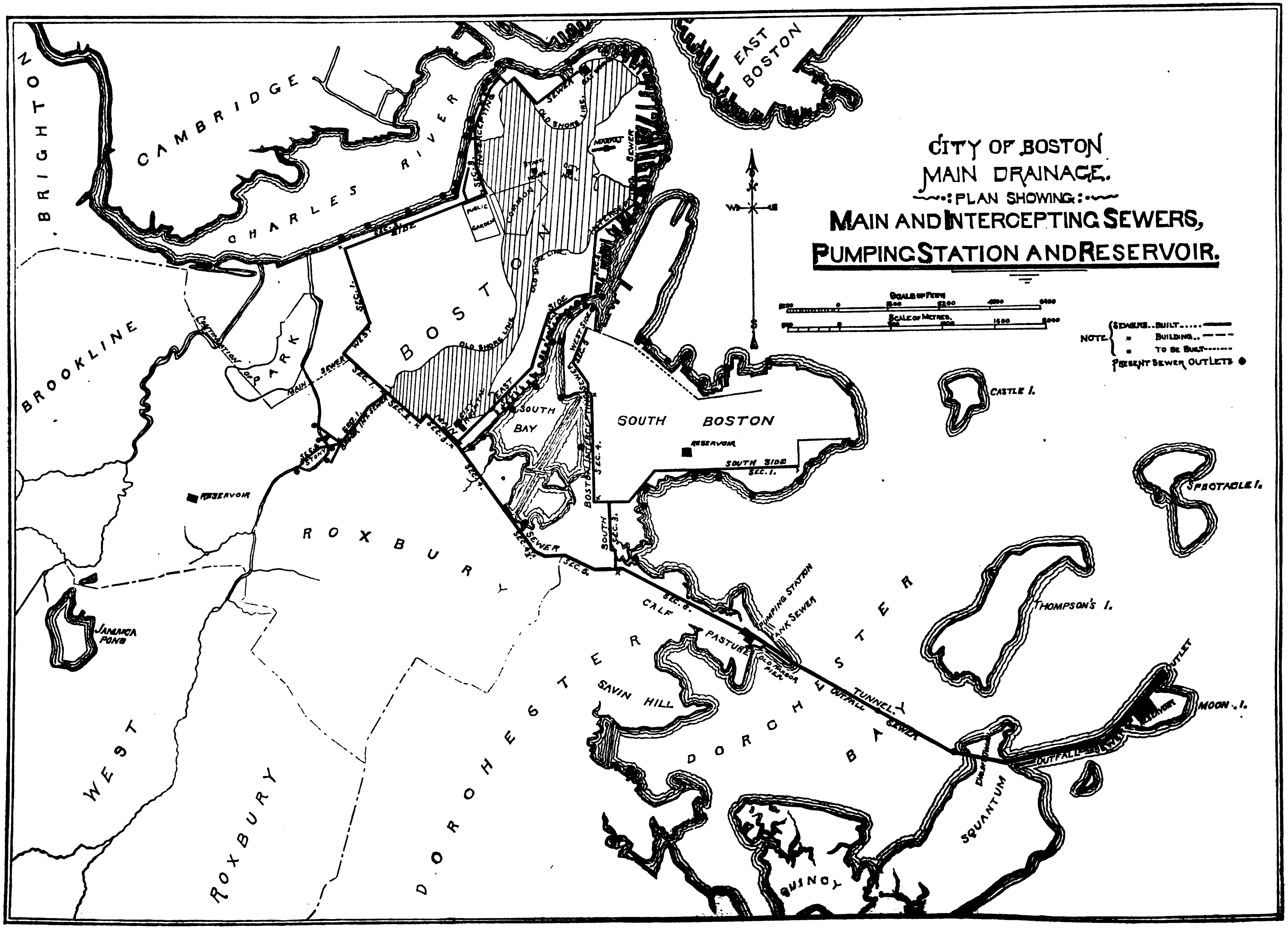
The city government when organized as above soon assumed the control of all such drains as had been laid in the public streets, and of the future extension of the system.

These drains had been constructed for the removal of waste-water from house-sinks and a portion of the surface-water from back yards, roofs, and low lands, but no fæcal matter was allowed to enter them, except by leakage, up to 1833. The overflows of vaults were then permitted to discharge fluids into the drains, but solids were still excluded, to be removed by night carts from vaults and cesspools. Water-closets were not generally introduced till since 1850.

Fortunately for the citizens, the topography of the city was such as to give this crude system, or rather lack of system, a certain degree of efficiency. The city was built on a hilly peninsula surrounded by tide-water, except at a narrow neck across which a stone could be thrown at high water, and had not then begun to reclaim the adjacent tidal flats, which have since contributed more than half the area now occupied compactly by buildings within the city proper. The accompanying map shows by its shaded area the original limits of the city, previous to annexations of territory and reclamations of flats.

These reclamations took place by degrees, and the new territory was variously provided with drainage. It is generally filled up to a few feet above high-water level, but in many cases the cellars had been constructed actually below the daily tides, while the storm-tides rose occasionally three feet higher than the average, flooding hundreds of cellars in the low districts.

In December, 1872, the city was authorized to "establish a grade" limiting the levels of cellar bottoms to a height not less than twelve feet above mean low water



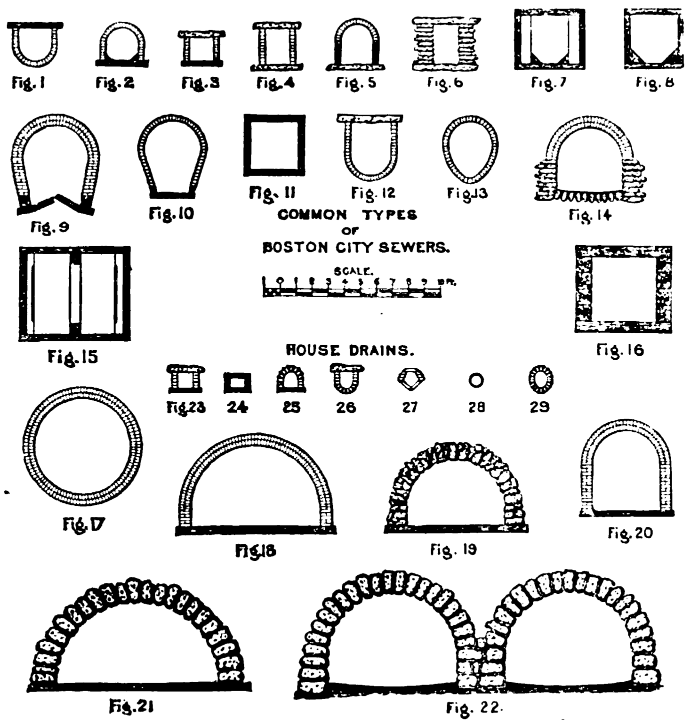
CITY OF BOSTON
MAIN DRAINAGE.
PLAN SHOWING:
MAIN AND INTERCEPTING SEWERS,
PUMPING STATION AND RESERVOIR.
NOTE.
SEWERS..BUILT
BUILDING..
TO BE BUILT
PRESENT SEWER OUTLETS
BRIGHTON
CAMBRIDGE
CHARLES RIVER
BROOKLINE
PARK
BOSTON
OLD SHORE LINE
PUBLIC GARDEN
COMMON
EAST BOSTON
SOUTH BAY
SOUTH BOSTON
RESERVOIR
SOUTH SIDE
ROXBURY
WEST ROXBURY
JAMAICA POND
DORCHESTER
CALF PASTURE
PUMPING STATION
SAVIN HILL
DORCHESTER BAY
TUNNEL
SQUANTUM
QUINCY
CASTLE I.
SPECTACLE I.
THOMPSON'S I.
MOON I.
OUTLET

(two feet above mean high water), and such an order was at once passed.

Among the reclamations thus made there was a large district that had been filled by a corporation or land company called the "South Cove Company," which had laid out streets, and made sewers therein, selling land and offering the streets to the city for acceptance. Such sewers had been built mostly on soft bottom, and were constructed of plank, laid in the mud without other support. The filling placed over them had often caused them to settle unequally, and it became difficult to judge, in many cases, which way it was originally intended that the water should run through them, except by finding in which direction they connected with tide-water.

As the filling progressed, occupying successive districts, one after another, these sewers had been extended from time to time by the private owners or corporations, with little or no inclination and often with little regard to stability.

Some of them were protected at the mouth by valve-gates to shut out the tide, but as the sewage was set back every twelve hours during the interval of high water, deposits accumulated rapidly, requiring frequent expenditures for their removal. It is estimated by Mr. Clarke, that in 1873 there were about 125 miles of sewers in the city. The rapid development of the "Back Bay district and the construction of the intercepting sewers increased this total to 226 miles in 1885, into which more than 100,000 water-closets discharged."



The accompanying plate, copied from Mr. Clarke's work, shows the various forms of sewers existing in 1875.

It will be noticed that of the first seventeen forms shown in this plate only two—viz., Figs. 13 and 17—are in accordance with good modern practice. Figure 13 is a good form for small brick sewers, as well as for larger ones where the flow is quite variable, and where there is plenty of available depth between the flow-line and the invert. The circular form, as shown in Fig. 17, is often used where it is desired to limit the vertical diameter for lack of proper depth, and where the flow is always enough to avoid deposits. Sediment is more likely to collect with a circular form than with the narrow bottom or egg-shaped section, especially when the volume of sewage is small. The semi-circular forms, given in Figs. 18 to 22, are only advisable where brook-channels are occupied and brook-water admitted, and where comparatively little sewage is dealt with. These stone arches were used for the conduit for "Stony Brook," so-called, a stream draining an area of 8,000 acres, as stated by the Back Bay Commissioners, and which has recently given much trouble by reason of the insufficient size of its conduits for a portion of its length in that part of the city formerly known as "Roxbury."

It will be noticed that the modern city of Boston has to deal with a surface much more difficult to drain than that of the old hilly peninsula. The districts lately reclaimed have a considerable area and are but little elevated above tide-water, while hundreds of cellars are below that level. The evils resulting from this state of things were manifold. The decomposition of the sediment collected in these long and poorly-constructed mains kept up a continual supply of noxious gases for which no adequate means of escape was provided. The accumulation of sewage or tide-water in the mains during the daily tides forced these gases every twelve hours into the poorly-protected house-drains, and through these into the houses even on more elevated ground. Bad as these results were, the attention of the public was more particularly awakened to the growing evils by the accumulation of sewage sediment around the numerous outfalls, which are shown on the map in sixty-two different places, most of which were so situated as to afford no certain flow beyond these points. Of course, the mud flats by which the city was surrounded were becoming extremely foul and offensive. The City Board of Health described the condition of things as follows:

"Complaints of bad odors have been made more frequently during the past year than ever before."

"They have come from nearly all parts of the city, but, especially and seriously, from the south and west ends.

"Large territories have been at once and frequently enveloped in an atmosphere of stench so strong as to arouse the sleeping, terrify the weak, and nauseate and exasperate everybody.

"It has been noticed more in the evening and night than during the day, although there is no time in the whole day when it may not come.

"The sewers and sewage-flats in and about the city furnish nine-tenths of all the stenches complained of.

"They are much worse each succeeding year; they will be much worse next year than this.

"The accumulation of sewage upon the flats and about the city has been and is rapidly increasing, until there is not probably a foot of mud in the river, in the basins, in the docks, or elsewhere in close proximity to the city that is not fouled with sewage."

Up to 1873 no radical measures had been taken to cure these evils. Local extensions of certain main sewers had been made in some places, resulting in transferring the nuisance a few hundred feet from one place to another, but now here was the sewage conveyed to deep water where any daily current existed capable of carrying it beyond the chance of returning with the next tide, while by far the greater part of the solid matter held in suspension was allowed to settle in the immediate neighborhood of the sixty-two points of delivery.

(TO BE CONTINUED.)

WATER-METERS.*

IT is the intention of this paper to sketch the development of the water-meter as a mechanical device. All questions as to its value as a means of checking waste and as a method of equitably adjusting rates are not considered here, but may be said to be answered by the constantly increasing demand for an efficient and cheap meter.

The history of its development as a piece of mechanism may be traced in the Patent Office; and it is from the patent records of the United States, England, France, and Germany, and from a few scattered publications that the data of this article are taken. The observations submitted are the result of practical experience in a long series of experiments, and are offered simply as opinions.

It is remarkable that upon a subject of such importance so little has been written. The same unprejudiced thought and study as has been given the steam and other engines is entirely wanting. It appears to have been studied only by inventors and experimenters who have carefully guarded their work and reserved their conclusions for themselves. Every other form of engine or motor (for a motor is but a special adaptation) has been fully elaborated, and there are many authorities upon every subject, theoretical or practical, connected therewith, while upon the water or fluid meter information as to its mechanical or operative details is almost entirely wanting. It was on this account that the Patent Records were searched as a record of experimental work. As to their value as a source of information or authority, it will be seen that each specification must be read with caution, as many conceptions therein described do not even reach the experimental stage, while by far the larger proportion are abandoned by the time the patent is printed. A search as to novelty should comprise, and in the United States Patent Office does comprise, not only the class of meters, but that of engines, motors, and pumps, and of specific parts. A task of this kind is truly formidable, for to be complete it should comprise a search of record in all patent-granting countries.

The United States patents—class of meters—number at this reading five hundred and fifty-two; those of England and Colonies nearly as many more, and the number is well approached by the sum of those of France, Germany, Belgium, and others. Here will be found the names of well-known engineers who have considered the water-meter worthy of their expert attention, and who have produced some very excellent machines; while, on the other hand, it has decidedly suffered at the hands of the entirely inexpert and ignorant, who have succeeded only in shrouding it in a kind of mystery and in producing the common impression that a successful meter is about as unattainable as perpetual motion. While an enormous amount of money has been expended in experiments, the total number of patents probably representing but a part, only a small portion has been utilized in well-executed design, as shown by the very few efficient devices in the market. If this statement is true, there must have been some special difficulty peculiar to the problem. It can be shown that if one element, that of cost, were eliminated, mechanical defects could be easily overcome. Efficient and cheap it must be in order to meet a demand which does not exist for a high-priced machine. It is the cost at which it must be produced which makes its duty and requirements in excess of almost any other automatic machine.

There are a number of excellent meters in use whose operation may be said to be practically all that is desired, their limited application being not on account of any defect, but because of their high price, which arises from their size, weight, and cost of manufacture. It may be noted here, that in a comparison of economy of meters, durability and permanency are as great a factor as price.

Ideas of what constitute efficiency vary with almost every water department. Special prominence is generally given to one particular feature to the oversight of others of equal or greater importance. However, they average up about as follows: To be efficient, a meter must be accurate within a permissible error, under extremes of pressure and rates of flow of perhaps 2 per cent. in favor of either department or consumer, and must maintain this standard with a reasonable, or rather an unreasonable, degree of permanency. It must not materially or noticeably retard the flow or diminish the pressure, and should be able to pass without stopping, clogging, or breakage, substances often carried along with the water, such as sand, sediment, pipe-scale, etc. It must be able to withstand without damage water-hammer caused by sudden closings, and in itself produce none, or make any noise from its working parts. Altogether, it must be compact, of non-corrosive material, inexpensive in repairs, and capable of standing abuse rather than use. It will be observed that a number of these requirements are not inherent in a measuring apparatus, but have been introduced by the defects of meters themselves.

Of the United States patents on meters two hundred and thirty-nine are of the piston type, one hundred and eighty-three are rotary, fifty are diaphragm, and eighty are oscillating. There are in addition a number of miscellaneous which admit of no large classification, such as those of the purely inferential and proportional type.

The reciprocating piston meter in its severally perfected forms is a practical measuring device, its efficiency being limited only on account of its large cost arising from the expensive non-corrosive materials used in a necessarily bulky construction. The mechanical problems of a piston meter have been fairly met. It is required that a piston be forced by water controlled by a suitable valve device to traverse a cylinder and return to its starting point. The amount of water displaced or measured per stroke is equal to the area of the piston into the distance which it travels. Connected with a properly constructed counter or register the mechanism is complete. Of more than two hundred United States patents in this line but two or three have met with popular favor and are able to meet the market at anything approaching the required price. The others, which in many instances show great ingenuity, have either misconceived the object sought for or utterly failed mechanically. Many large and costly meters have been designed under the impression that there were no good piston devices in use. These, of course, although they may be efficient, are unavailable on account of their cost. The mechanical failures above mentioned are in most instances absurdities in the outset.

The best forms of the steam-pump and other piston engines have their adaptation in more or less practical water-meters. A special arrangement of the parts is made whereby the valve mechanism is entirely inclosed, and in such manner that there are no moving parts or connections outside the case. The duplex pump is represented in a double-plunger meter in which a pair of double-acting plungers operate in conjunction with a pair of slide-valves. The single pump is represented in various forms of single piston meters in which the valve-gearing is operated by a supplemental piston and valve, or by weights, springs, etc.

In order to come within the narrow limits of price, many attempts toward a reduction of size and weight have followed, and as a result some of the special requirements of a meter have been sacrificed. As an instance, in the attempt to make a single piston do the work of two an infinite variety of valve mechanisms have been devised with a view of obtaining the same easy movement found in the best double-piston meters. The uniform result has been that either the single-piston meter must be made large enough to equal in capacity the double-piston or one of the following defects would ensue:

First—A mechanical noise caused by the striking of the moving parts, such as would come of the use of levers, weights, or springs in obtaining a reverse movement of the piston, or in the use of a supplemental valve, by the main or auxiliary piston striking its bunters.

Second—Water-hammer caused by the checking of the flow at the instant of reversal of the main valve; or, third,

* Abstract of a paper by J. A. Tilden, member of the Boston Society of Civil Engineers. Read November 17, 1886.

if this is avoided by the use of poppet or open, slide or piston valves, an annoying inaccuracy of registration ensues from the varying loss of water under different conditions at the time the valve is changing. The double piston in one of its best forms operates upon precisely the same principle as the steam end of a duplex pump, the piston, or plunger as it is in the meter, moving a slide-valve which controls the water for the other plunger, which in turn operates a valve for the first. All piston, valve, and connecting rods are dispensed with, as the valves are inside of the case and moved by direct contact with the plungers.

Vibrating or oscillating pistons have been tried in many forms with little satisfaction, as the increased cost of construction overbalances the reduction in weight.

Flexible diaphragms have been substituted for the piston, and combined with every valve-gearing found in the piston and oscillating types, but still the diminution of size and weight is not found.

The opinion is submitted that almost any positive displacement device constructed on good mechanical principles, and, of course, specially adapted for the work, would be a mechanical success as a measuring apparatus, and would be a commercial success were it not for the rigorous lines drawn by the very limited price at which it must be produced and sold.

There is a large class of inferential meters which come under the head of rotaries; all measuring wheels, turbine screw, and reaction come under this class, as they infer that for a given number of revolutions a certain amount of water will pass. It can be seen and experience has proved that only an unsatisfactory approximation is the result. Many, however, are yet in use in England, Germany, and other foreign countries, as the piston meters made and in use there are very expensive. The purely inferential meters are those which infer that a certain amount of water will pass through an orifice, the size of which is controlled by the flow. Registration is obtained and figured from a recording gauge, which is operated by a piston or other valve at the orifice. A degree of success has been obtained in this way on large pipes.

Proportional meters were among the earliest conceptions for the registering of water in large quantities. In these a relatively small portion is deflected from the main pipe and measured by positive displacement, the principle being that the fluid will divide proportionally under relatively equal resistances. It has been found that, on account of the varying retardation of the metered part under the different conditions of pressure and flow, a regulating valve of great delicacy is required to deflect the proper quantity from the open pipe to the meter, according to the reductions of pressure at the point of discharge. The serious defects are, first, the multiplication of error, which is in the same proportion as the unmetered part to the metered; and, second, any clogging or imperfect action of the regulator may put the entire amount through the meter, or, under other conditions, none through it, and the whole through the pipe without registering. This plan, as yet, has met with little favor, and may be said to have scarcely gone beyond the experimental stage. Its entirely inferential character and great delicacy renders it little more than a guessing machine.

A number of devices, such as tilting tanks, floats, and weighing wheels, are simple and effective where they can be used for delivering water without pressure into a tank, but, of course, are entirely unavailable for the market, as the introduction of a meter on a pipe must not reduce or affect the pressure.

A positive displacement rotary, in distinction from the turbine or screw-wheel type, has constantly been sought for as the solution of an efficient low-priced meter. The same observation applies here as in the reciprocating piston. Almost any reasonable, well-constructed rotary piston will measure water if not overcrowded, but with few exceptions they would have to be made so large as to be unavailable, or, if reduced in size, are sure to introduce the same defects as noted in the reciprocating meter.

The lifetime of a meter is determined by the wear of its parts, which in turn depends upon the friction. Tight fitting is to be discouraged, as it is productive of friction and inaccuracy. It is evident that in order to reduce a meter to the size required by a marketable price, the working parts must move with great rapidity. That is to say, if it is desired that a very small part do the work of a large one, it must of course move very fast. This means the use of a revolving piston in preference to a reciprocating. It is obviously impossible for a reciprocating piston to attain the speed in a non-elastic fluid that a continuous motion or revolving piston is able to reach. In view of this, it is thought that this rule will apply. All moving parts in a high-speed meter must be either balanced in action or compensating for wear.

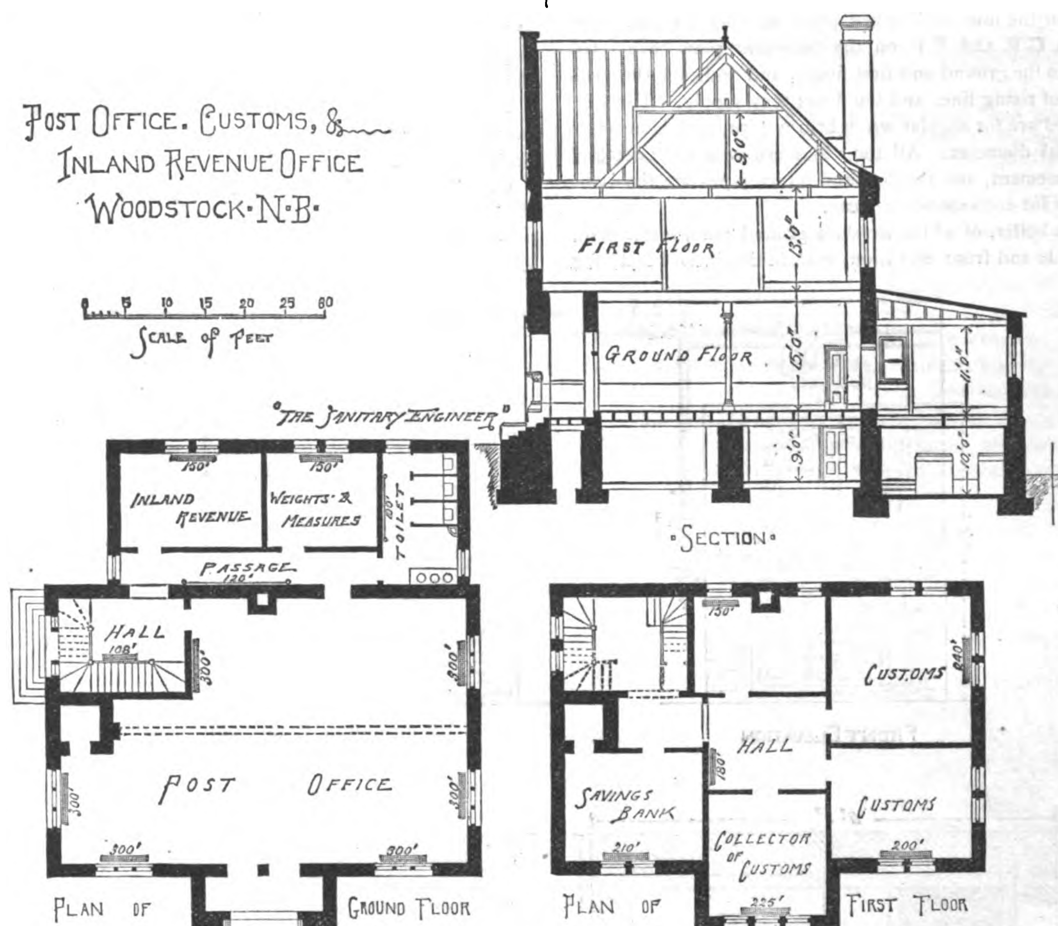
THE Philadelphia Water-Works has made a test of the relative value of pea, egg, and soft coal for steam purposes. The tests were made at Belmont pumping-station. Hard pea coal did 35.8 per cent. more work than the egg for a dollar, soft coal 26.6 per cent., and dusty pea coal 49.4 per cent. more. The tests extended over 48 hours, and were remarkably uniform in the conditions. Soft coal showed the highest "duty" and the "egg" coal came next, but the price told the story. Clean pea $2.30, egg $4.38, soft coal $3.58, dusty pea $2.65, are the relative costs of the different kinds for a unit of work.

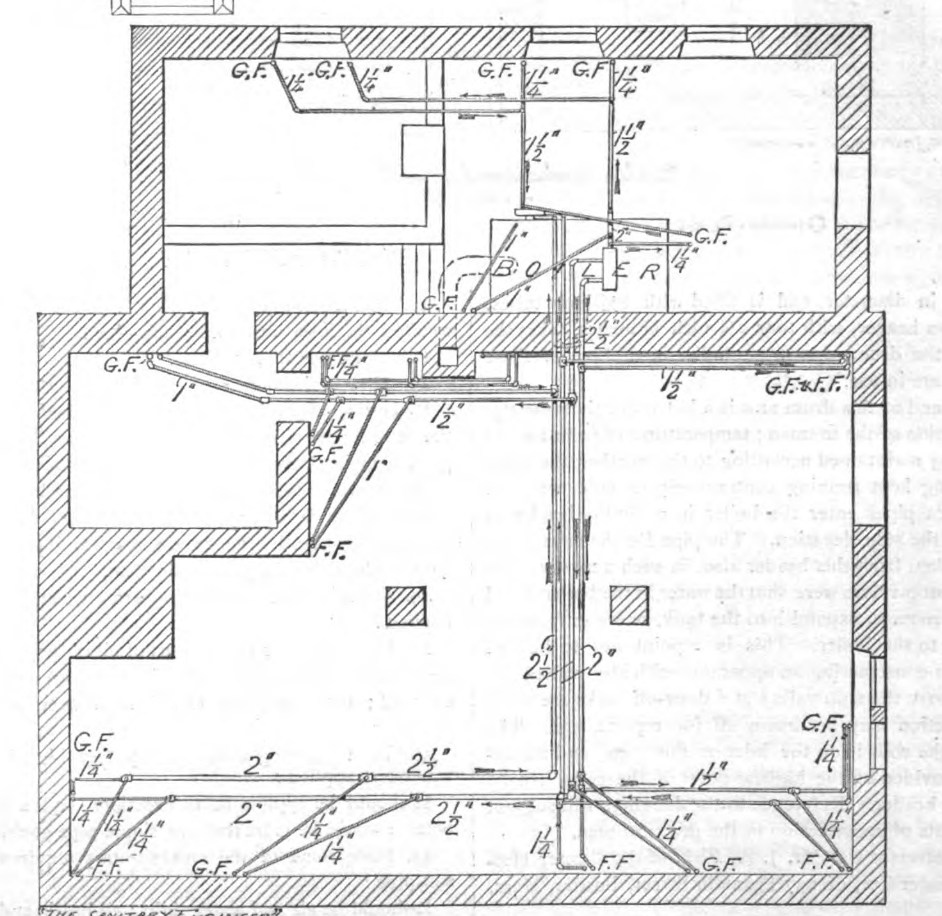
DOMESTIC PLUMBING, HEATING, LIGHTING & VENTILATION ENGINEERING

WARMING OF THE POST OFFICE, CUSTOMS AND INLAND REVENUE OFFICE BUILDING, AT WOOODSTOCK, N. B., BY HOT WATER.

THE accompanying drawings illustrate the warming by a hot-water apparatus of the Post Office, Customs and Inland Revenue Building, at Woodstock, N. B., and shows the boilers, size of pipes, and the quantity of heating surface used. Before proceeding to describe the work, however, we wish to call the attention of our readers in the United States to the fact that in the Dominion the ground floor of a building is what we call our first or main floor, and that the first floor occupies the position of our second floor. Therefore, when we allude to the ground floor in this case we mean the main floor, and an allusion to the first floor means one flight of stairs above main or ground floor. This is seen fully in the plans and section.

The ground floor of the main building is occupied by the Post Office and the extension by the offices of the Inland Revenue and the Sealer of Weights and Measures. The first floor is occupied by the customs offices and a Postal Savings Bank.





—Plan · of · Basement—

The heaters used are return-bend or box-coils, and their sizes and positions are shown on the plans, thus:

300′

as in the Post Office, the lines representing the pipes, and the number being the lineal feet of 1-inch pipe in the coil; a single line meaning a "flat" coil—*i. e.*, one that goes flat against the wall, and has but one section of pipes.

The section shows the height of the floors and windows, and with the aid of the scale attached any one particularly interested can obtain the amount of heating surface used to a given window-glass and outside wall surface, from which to formulate data for future guide and reference. It also gives the height of basement and length of rising lines.

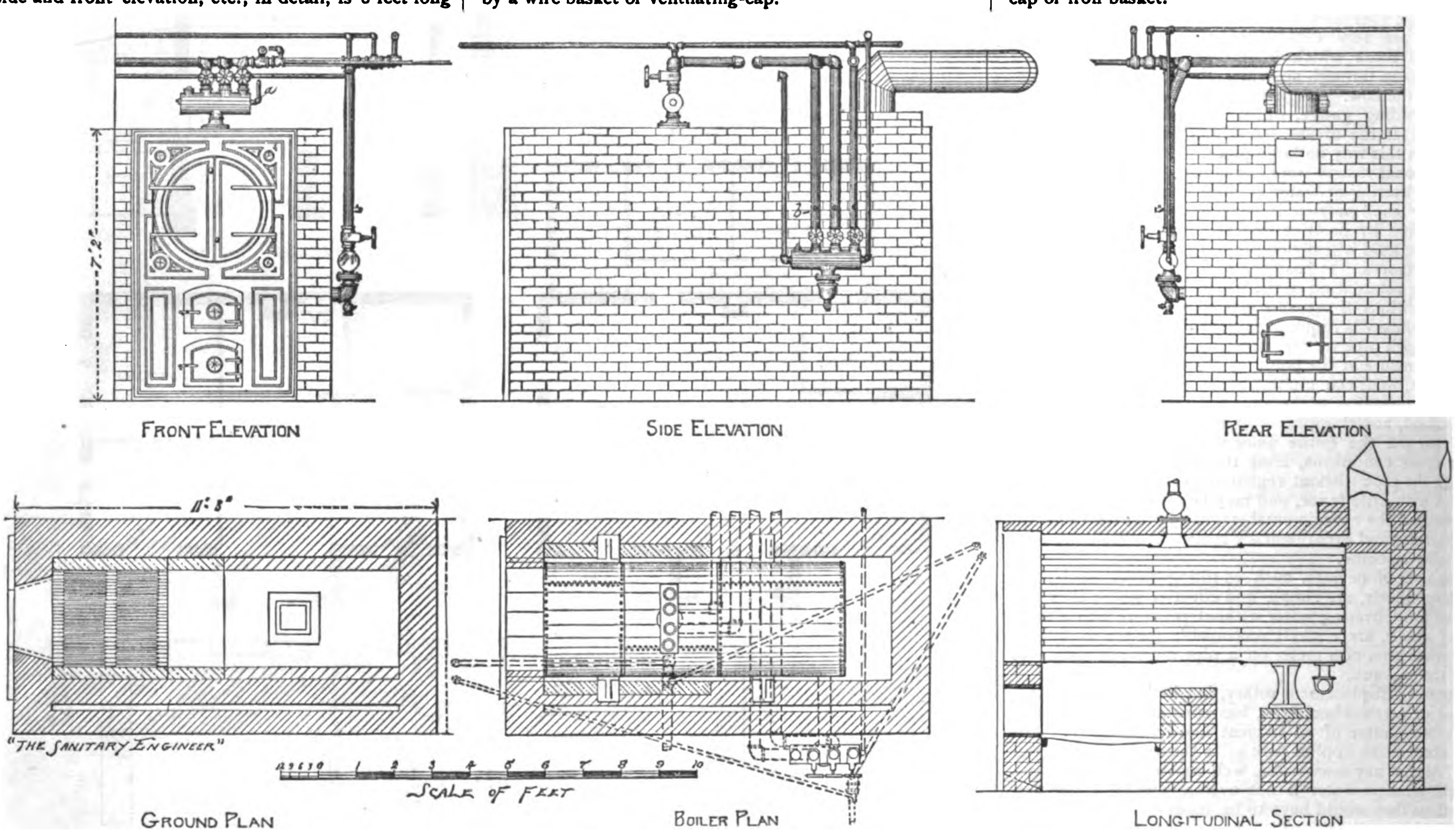
The plan of the basement gives the actual positions and sizes of the flow and return pipes as they are run. The letters G F and F F on the basement plan have reference to the ground and first floors, and indicate the positions of rising lines and the floors they supply. The sizes marked are for regular wrought-iron pipe, and indicate its internal diameter. All the pipes are near the ceiling of the basement, and the flow and return pipes are the same in size for corresponding parts.

The boiler, of which we show ground plan, boiler plan, and side and front elevation, etc., in detail, is 8 feet long by 3 feet in diameter, and is filled with 2½-inch tubes. A cast-iron header, with four 2½-inch branches, takes the place of the drum of a steam-boiler, and three of these branches are in use.

At the end of this drum at *a* is a hot-water thermometer for the guide of the fireman; temperatures of from 140° to 200° being maintained according to the weather, the apparatus being kept running continuously in cold weather. The return pipes enter the boiler in a similar header as shown in the side elevation. The pipe for the expansion-tank is taken from this header also, in such a manner that if all the stop-valves were shut the water in the boiler would still have room to expand into the tank, or water from the tank flow to the boiler. This is a point not to be lost sight of in constructing an apparatus with stop-valves.

Just above the stop-valves at *b* draw-off cocks are used, that a section may be drawn off for repairs, etc. The valve on the coils is on the inlet or flow-pipe, and an air-vent is provided on the highest point of the coils, usually the upper header. Reference to the drawings will suggest other points of construction to the practical man.

The contractor was Mr. J. A. Fish, of the Gurney Hot-Water Heater Co., of 237 Franklin Street, Boston, Mass.



POST-OFFICE AT WOODSTOCK.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. III.

(Continued from page 139.)

SOIL-PIPES (CONTINUED).

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

42. What fall per foot should a horizontal soil-pipe have?

At least one-quarter inch to the foot and not more than one inch.

43. How should a branch-pipe enter a soil-pipe, and why?

By a Y-branch at an angle of 45°, or a ½-Y if it suits the nature of the work better. Right-angle junctions are objectionable, as they are liable to choke and form deposits.

44. Is there any objection to building a soil-pipe into the wall?

Yes; the settling of the wall is likely to crack pipe and cause leakage; besides, it is inaccessible, and therefore difficult to repair.

45. What should be done to a soil-pipe above the highest fixture?

It should be extended above roof and the end protected by a wire basket or ventilating-cap.

46. Can a soil-pipe be cut after it is put into a building to allow the insertion of a branch-pipe?

It is quite possible to do so.

47. How is this done?

By cutting above hubs with a sharp chisel and removing the length; then inserting the necessary Y-branch and pipe, using a sleeve to make the final connection.

48. How can the soil-pipes in a building be tested?

By various means, as filling with water, by a proving-pump and gauge, by the smoke test, and also, as is frequently done, by the peppermint test.

49. What is meant by the peppermint test, and how is it applied?

By diluting one or two ounces of oil of peppermint in a pailful of hot water and pouring it down through main pipe on roof; then carefully examine all over building for the odor.

50. In a building over seventy feet high how is the water-test applied?

It should be applied in two sections, or the pressure at bottom would be more than the single pipe could stand.

51. State some of the chief sanitary requirements of a soil-pipe?

It should be air and water tight; all bends and branches have the necessary sweep; provided with sufficient water to flush thoroughly the entire pipe periodically; the admission of fresh air at bottom, and no dead ends for sewer-gas to collect in.

No. 2.

THE TRAPPING AND VENTILATION OF SOIL-PIPES.

1. What is the object of a trap?

The prevention of sewer-gas from entering house or fixtures.

2. How is this effected?

By a water-seal made by confining water in a depression of pipe which is called a trap.

3. Is this an effectual remedy?

When properly done it is entirely so.

4. Will the water in a trap absorb gas and emit it again?

To a certain limited extent, but not enough to be an objection.

5. How is this difficulty over come?

By changing water in trap frequently and by ventilating pipe—that is, permitting air to circulate.

6. Where should the open end of a pipe be situated, and how is the pipe usually terminated?

At the highest point of building, and capped with a vent-cap or iron basket.

7. What is the object of a trap where the drain-pipe enters the house?

To prevent the entrance of sewer-gas from street-sewer.

8. Is there any other theory on this point?

Sewer-air should not be confined, but allowed to escape and become diluted with fresh air.

9. What is the theory of the New York City Board of Health in regard to this trap?

That sewers should not contain gas, but, as usually built, they do.

10. What causes a pressure from the sewers on the main trap?

Difference in temperature between sewer and house; snow on opening and manholes; tides blocking outlet, etc.

11. Can the difference in temperature between the air in a sewer and in a drain-pipe unseal a trap?

Yes, if the sewer-air is confined, but not if unconfined.

12. Will open fires cause a suction on sewer-pipes, and why?

Yes, they draw air from where there is least resistance; fires will rarefy the air.

13. What is the best form of a trap at the outlet of a drain-pipe, and of what material should it be?

Running trap, with handhole to clean out, and of iron.

14. Does a large body of water in a trap afford greater resistance to pressure from the sewer?

No.

15. What constitutes the resistance to pressure in a trap?

The depth of seal, but not the amount of water in trap.

16. How deep should the water-seal be in a running trap?

About 1½ or 2 inches.

17. What is meant by depth of water-seal?

The depth of the water between the outlet of trap and bridging or dip.

18. Is there any objection to a deep trap?

If too deep it is not self-cleansing, and matter will not be discharged.

(To be Continued.)

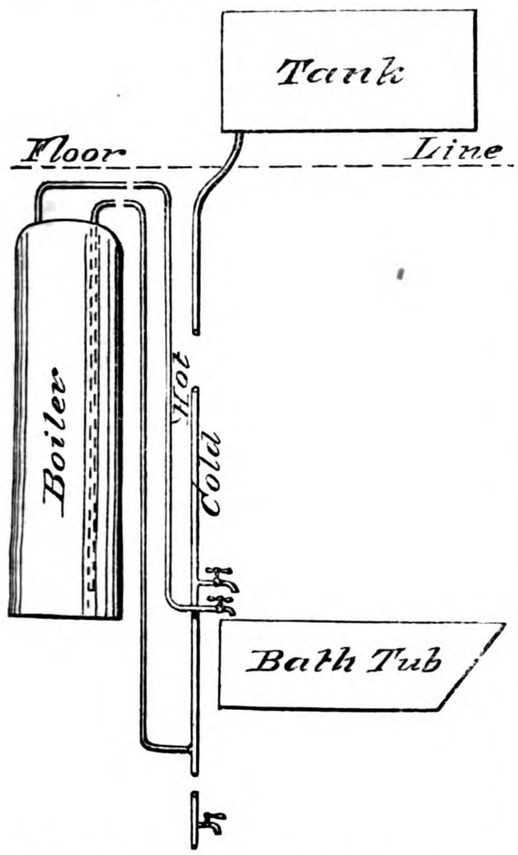
Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

DIFFICULTY WITH A KITCHEN-BOILER CIRCULATION.

NORFOLK, VA., January 18, 1887.

SIR: If your correspondent, J. S. J. (issue of January 15, difficulty in obtaining hot water), will connect his boiler



as per the sketch given on the other side of this page, he will have no more trouble with the job. Very truly, etc.,

W. E. FOSTER.

[Our correspondent's illustration will appear to the casual observer the same as that furnished by "J. S. J.," in our issue of January 15, page 165, and "J. S. J." may ask "where the difference is." In fact, there is not a great difference, but the broken lines near the head of the boiler in this case indicate that Mr. Foster intends to carry the hot and cold water from the head of the boiler along the kitchen ceiling and adjoining rooms, whereas "J. S. J." dropped at once below the floor and carried them in that direction.

We think, however, the vent-pipe, if it is practicable, or rather if there is no good reason why it should not be run, is the proper way to overcome the trouble.]

NEW YORK, January 22, 1887.

SIR: If Mr. J. S. J., who has made inquiries in your issue of January 15, 1887, respecting the imperfect supply of hot water through a boiler, which is filled from a tank situated at a point a short distance above said boiler, will connect a small tube, say ⅜-inch, with the outlet or hot-water pipe at a point immediately above and over the boiler, and run the same with an even ascent and with as few bends as possible to a point above the tank, or turn the same over the top of tank, he will have no trouble in obtaining plenty of water.

The theory is this: Heating the water-back produces a steam-pressure (in the absence of circulation) upon the boiler and on the mouth of inlet-pipe, which, in this case, is of short length, and, consequently, the water has little weight to force itself into the boiler against a head of steam. It must be remembered that the pressure at the dome and at the bottom of boiler are equal.

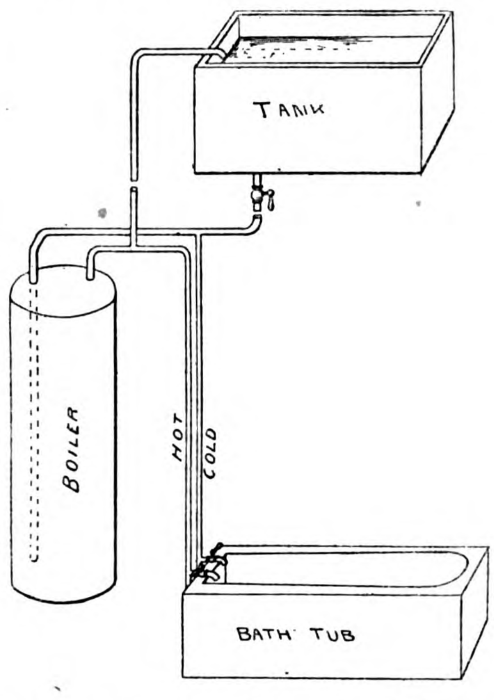
Again, his system of piping is defective and forms in itself an "air-lock" by having the pipes arranged so they are double-trapped.

The job should be altered according to inserted sketch, when all will operate.

His is not the only great mind which has been perplexed by this apprenticeship problem.

Your humble servant, LEONARD D. HOSFORD.

[The vent-pipe will let off the steam or air and allow the water to run. Our reason for not advising the vent in the



issue of January 15 was stated in our issue of January 22, page 188.]

FLOW OF WATER THROUGH A ONE-HALF-INCH PIPE.

WESTON, January 11, 1887.

SIR: A friend wishes me to write for a little information in regard to some water-pipe which he is laying on his estate. I send you the sketch which he furnished me, and will explain it as well as I can.

He wishes to bring water from a spring to a small reservoir, 1,550 feet from the spring, to supply his house, barn, and garden.

The sketch will show the elevations, etc.

Now, he has laid a ½-inch lead pipe nearly the whole distance, but there has been some doubt expressed as to his getting the water so great a distance through so small a pipe, especially when the lay of the land is considered. If you can inform me by letter or through the columns of your valuable paper how much (if any) water he is likely to get by the ½-inch pipe, and what size and kind of pipe in your opinion would be best and most economical in the end to use in such a place, you will greatly oblige,

Yours respectfully, I. W. HASTINGS.

P. S.—The pipe followed the surface of the ground, there being depressions in several places.

[The action of a very small pipe under such circumstances is somewhat problematical. Using the formulæ given in an article on this subject on page 325 of Vol. VIII., we would get one gallon discharge in about five to ten minutes, depending on smoothness of the pipe. As there are two considerable depressions in the line in this case between the spring and the reservoir, the question is complicated by the possibility of air collecting at the summit between the depressions. A larger pipe is very desirable, and it should be provided with an air-cock at the summit, for use if required.]

HOW TO ARRANGE A STEAM SWEATING-BOX.

LANCASTER, PA., January 27, 1887.

SIR: As one of your subscribers who never as yet asked you a single question, I now respectfully desire your opinion on the following—viz.: C represents a resweating-box, with a box within a box, allowing a water-space x between the two boxes. F is a lid set into a water-trough all round the upper edge of boxes; this forms a seal-joint. At d is a steam-pipe of (say) 1¼ inches, leading from boiler B; e is a return-pipe of (say) ½ or ¾ inch, leading from bottom of said boxes to the boiler at its bottom. By carrying (say) 15 or 20 pounds steam, or as much as lid or cover F will bear without blowing off, will the water in said space and the boiler B carry itself on a level in both boiler and box, as shown by dotted line a? My opinion is it will; others say it will not, and that I might spend hun

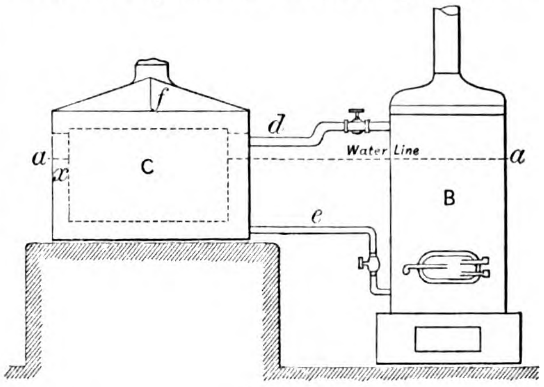


FIG. 1.

dreds of dollars in experimenting and could not make it work. Can it be done, and if so how must it be arranged? If different from what I show above, an early reply through your paper will oblige,

Yours truly, EZRA F. LANDIS.

[The direct question of our correspondent is: "By carry-as much steam as the lid or cover f will bear without blowing off, will the water in the space x and the boiler B remain on the same level?" Our answer is, practically it will, if the pipes d and e are amply proportioned. Actually the water in the box will be a little the higher.

There are other questions, however, involved which are not directly asked: No water-seal can be arranged to withstand 15 or 20 pounds pressure in the apparatus, as you design it, nor will it be practicable to load a cover to

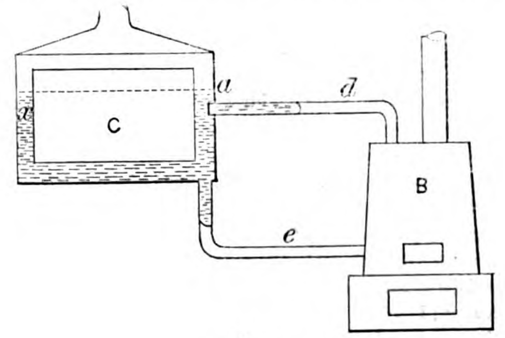


FIG 2.

withstand 15 or 20 pounds pressure. If you bolt the cover on or clamp it on, then it will work as you desire, but otherwise it will only work at a few ounces above atmosphere. If steam at atmospheric pressure, however, will suit your purpose, or the vapor of hot water, then we think a more practicable and less troublesome apparatus might be devised as follows, and shown in Fig. 2: B is a hot-water boiler connected to the box by ample flow and return pipes d and e. The boiler and the space x are filled to the line a and the circulation of very hot water will go on through d to the box and return by e, giving off its hot vapor in the box. Should the water in the boiler pass 212° the vapor or steam will be retained to an extent equal to the water-seal; a 7-inch depth of seal holding against four ounces of pressure.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
January 29...	25 03	19.3)	20 62	30.52	29.95	20.58	32.82

E. G. LOVE, Ph.D., *Gas Examiner.*

THE *Journal of Gas-Lighting* quotes a statement from a circular of the New York Edison Electric Light Co. to the effect that "there are in every day use about 400,000 Edison lamps, of an average of 16 candles each." The item further states that if reduced to a gas basis, this number of incandescent lamps "are equal to 400,000 6-foot gas-jets, or 57,600,000 cubic feet of gas per day. The total capacity of the gas companies supplying New York City is then given as 36,000,000 feet per day, and

the rather startling conclusion is reached that "the daily light-producing capacity of the Edison apparatus in use in the United States, whether expended in light or power, is more than fifty per cent. greater than that of the entire combined gas-works of New York City." This reduction to a gas basis is presumably the work of the Edison Co., and suitable allowances must therefore be made. For the week ending January 29 the average candle-power of the gases supplied by the seven companies on Manhattan Island was 25.5 candles, so that the 400,000 incandescent lamps, instead of being equal to 400,000 6-foot gas burners, are really equal to 209,150 such burners. The consumption of these burners in twenty-four hours would be a little over thirty million cubic feet of gas—less than the daily capacity of the gas-works in this city. Instead, therefore, of the light-producing capacity of the Edison apparatus in use in the United States being fifty per cent. greater than that of the combined gas companies in this city, the latter could furnish more light than all the Edison incandescent lamps in the country, and that, too, without working to their full capacity.

ILLINOIS CIVIL ENGINEERS.

THE second annual meeting was held in the State University at Urbana, beginning January 26.

Among those present were: S. S. Greely, S. C. Conton, H. A. Stevens, Colonel Foster, County Surveyor, Chicago; D. M. Mead, City Engineer, Rockford; W. A. Gajinnis, Kankakee; J. S. Burt, Moline; S. A. Bullard, City Engineer, Springfield; A. H. Bell, City Engineer, Bloomington; Z. A. Enos, Springfield; J. R. Lewis, Piper City; J. N. Clark, Duquoin; Captain J. Withington, Mattoon.

Vice-President T. J. Burrill delivered the address of welcome on behalf of the university, and C. G. Elliott, Chairman of the Executive Board, responded on behalf of the society. Professor I. O. Baker, of the Civil Engineering Department of the University, President of the society, then delivered the annual address—a review of the advances made in the different departments of civil engineering during the past year.

After the President's address reports of committees were heard and the following elected members: John R. Lewis, Piper City; Samuel S. Greely, Chicago; Daniel W. Mead, Rockford; Fletcher H. Chapman, Carlinville; Thomas S. McClahan, Monmouth; George V. Loring, City Engineer, Decatur; Jacob J. Foster, County Surveyor of Cook County, Chicago; Frank V. Alkire, Petersburg.

At the evening session the first report was that of the Committee on Sanitary Engineering and Water-Supply, by Professor A. A. Talbot, Champaign.

S. A. Bullard, City Engineer of Springfield, read a paper on combined *versus* separate system of sewerage for small cities.

Samuel S. Greely, of Chicago, read a paper on the license system for surveyors. He contended that as the law is now, the private surveyor had the advantage of the County Surveyor, because he has the same advantages and not the drawbacks of the latter. He advocated that the State should license engineers and surveyors, the same as physicians and lawyers.

Officers were elected as follows; President, Professor I. O. Baker; Vice-President, Colonel Foster; Executive Secretary, A. N. Talbot; Recording Secretary, S. A. Bullard; Treasurer, George P. Ela.

The next meeting will be held at Springfield, in January, 1888.

MICHIGAN CIVIL ENGINEERS.

AT the meeting of the Michigan Society of Engineers at Grand Rapids last week, W. R. Coats, of Kalamazoo, read a paper on river-crossings, containing a consideration of the different methods employed in carrying water-mains across rivers and water-courses, and detailing accurately the steps taken in the laying of the water-main across Grand River here last summer. Illustrations of the works as it appeared at different stages were exhibited. The society tendered its thanks to Mr. Coats for his excellent paper.

The Vice-President read an article from J. B. Davis on "Thatcher Slide Rule," useful in the solution of problems of bridge stresses or column formulas.

The report on State boundary, referred over from the previous day, was read by Mr. Hodgman. It contained a short statement of the early changes of the southern boundary line of the State of Michigan from a surveyor's standpoint, until finally determined by act of Congress June 25, 1836, and surveyed in June, 1837, by Andrew Porter, deputy surveyor, under direction of the Surveyor-General.

The Committee on National, Public, and Civil Works made a report which was adopted. The President appointed Committees on Credentials and Nominations.

Prof. M. E. Cooley read a paper on gas-engines.

Captain Coffinberry, with a few pleasant remarks, made a donation of valued instruments.

On motion of Mr. Appleton the donation was accepted by a unanimous rising vote.

A communication from President Davis was read, recommending the propriety of admitting ship-builders to the society and enlarging upon the importance which that branch of mechanical science has and must attain to in this State. This was referred to a special committee consisting of Messrs. Drew, Hodgman, and Rogers. Another communication from the same gentleman was read, relating to the combinations of bidders upon public works to the detriment of the honest bidder and the public; and another upon criminal labor.

Reports were heard at length from Messrs. Hodgman and Bellows upon surveying.

A paper was presented by Mr. Hodgman, of Kalamazoo, on a recent land case in the Supreme Court, that of Keyser *vs.* Sutherland. This is a decision in regard to fractional sections.

Kalamazoo was decided upon as the next place of meeting.

THE EQUITABLE BUILDING.

HARTFORD, CONN., January 29, 1887.

SIR: I see in your article contained on page 133 of January 8, 1887, and on page 182, of January 22, 1887, an error. I refer to name of contractor on stone-setting at the Equitable Life Insurance Building, Broadway. The firm of stone-setters is Angus & Dallas. Please correct and oblige, Truly yours, ALEXANDER DALLAS.

HEATING RAILROAD-CARS.

AT Boston, on Wednesday evening, January 12, the New England Railroad Club discussed the subject of heating railroad-cars, nearly 100 railroad men being present. It was the general opinion that the use of stoves must soon be abandoned, as the danger from their use is too great. Many of the speakers were in favor of heating cars by steam, though difficulties in the way of doing this were presented. Several railroad men thought that cars might be heated by steam from the engine, and in reply to the objection that frequently engines are not attached to trains until just before they start, it was urged that a boiler might be located in the station and steam carried through flexible pipes to the car. The system of heating by hot water was also commended. Several inventors were present, and pointed out the advantages of their several systems for heating cars.

BOSTON'S MORTALITY.

FROM the official return of N. A. Apollonio, City Registrar of Boston, it is learned that the number of deaths in 1886 were 9,263, a decrease of 359 from the number registered in 1885. The death-rate, therefore, was 23.39 in each 1,000 of the estimated population. This rate is slightly below the average one, which has been in the neighborhood of 24 in 1,000 for the last twenty or thirty years. The number of decedents under five years of age was 3,390, making 36.59 per cent. of the whole number. In 1885 the number of children who died under five years of age was 3,473—83 more than died in the past year. On the other hand, while only 2,160 children died under one year in 1885, there were 2,304 of that age who died in 1886, or 144 more in number. Of the principal causes of death, consumption, as always, is the most prominent. There were 1,092 deaths from this cause, an increase of 113 over the number of the preceding year, making 18.27 per cent. of the mortality from all causes. This rate is the largest that has occurred during the past twelve years. In 1878 the percentage was 18.12. In no other year of the period named did it exceed 17.48. The number of deaths from lung complaints, including pneumonia, was 770, a decrease of 239. Diseases of the heart caused 568 deaths, an increase of 15 over the number recorded in 1885. There were 718 deaths from diarrhœal causes—cholera infantum, diarrhœa, and dysentery—a decrease of 28 from the number of the preceding year. Croup and diphtheria caused 477 deaths, an increase of two only over the number of the preceding year. The mortality from brain diseases was 56 less than occurred in 1885, the number being 332. If the deaths from paralysis, insanity, and those reported from convulsions were embraced with the brain diseases (as many of them should be), the mortality, as above stated, would be somewhat increased. There were 44 deaths from suicide (a decrease of one), and 13 homicidal deaths, an increase of four. The deaths from the causes above stated, except those from external causes number 4,557, and make 49.19 per cent. of the entire mortality of the year.

The number of births and marriages during the year has not yet been ascertained. There were, however, 5,130 certificates of intentions of marriage issued, an increase of 354 over the number issued in 1885.

A PUMP CATECHISM.

THE "Pump Catechism," by Robert Grimshaw, M. E., and published by the Practical Publishing Co., of New York, is a book for every practical engineer in the country. It is a (large) 16mo., in cloth, of 223 pages of reading matter, and is intended evidently for the pocket as a *vade mecum*. It describes and illustrates the construction and operation of nearly all the present types and makes of pumps to be found in daily use, giving special instruction in the various features, and treats of pumps generally and the principle under which they act. No engineer, steam-fitter or plumber should be without one. Architects and professional men will also find useful information and illustrations of parts of pumps collected that is not, we believe, otherwise obtainable in so small a compass. The price is $1.

TRADE CATALOGUES.

WE have received the "Descriptive Catalogue" of the Osgood Dredge Company, giving a number of plates and illustrations of their improved boom-dredge machines and excavators, with details of construction, and a description of a comparative diagram of strains is also given, together with other useful information.

Patents.

354,240. Steam-Cooker. Henry P. Roberts, Jamestown, N. Y. Filed January 22, 1886. Issued December 14, 1886.

354,248. Grate for Furnaces. Charles T. Schoen, Philadelphia, Pa. Filed May 1, 1886. Issued December 14, 1886.

354,252. Revolving Gas-Fixture. Joseph J. Seidschec, Chicago. Ill. Filed February 4, 1886. Issued December 14, 1886.

354,265. Earth-Auger. Joseph S. Stephen, Joliet, assignor to himself and Joseph B. Shute, Chicago, Ill. Filed April 20, 1886. Issued December 14, 1886.

354,285. Tank-Valve. Peter White, St. Louis Mo. Filed October 4, 1886. Issued December 14, 1886.

354,300. Vapor-Burner. Henry S. Belden, Canton, Ohio. Filed January 18, 1884. Issued December 14, 1886.

354,305. Hot-Water Apparatus. Samuel F. Collins, Binghamton, N. Y. Filed April 14, 1886. Issued December 14, 1886.

354,312 Apparatus for Opening and Closing Dampers. Richard J. Flinn, Boston, Mass., assignor, by direct and mesne assignments, to the Flinn Mercurial Regulator Company, Portland, Me. Filed November 30, 1885. Issued December 14, 1886.

354,348. Water-Tight Bulkhead for Underground Railways, etc. John E. Robinson, Baltimore, Md. Filed August 2, 1886. Issued December 14, 1886.

354,350. Conduit for Cable or Electrical Railways. Edward Samuel, Philadelphia, Pa., assignor to William Wharton, Jr., & Co. (Limited.) same place. Filed February 26, 1886. Issued December 14, 1886.

354,368. Feed-Water Heater. Harry Wilson, Philadelphia, Pa. Filed April 3, 1886. Issued December 14, 1886.

354,379. Water-Closet. August F. Blesch, Columbus, Ohio. Filed March 6, 1886. Issued December 14, 1886.

354,392. Steam-Boiler. Alfred Catchpole, Geneva, N. Y. Filed September 15, 1886. Issued December 14, 1886.

354,414. Valve. Patrick Harvey, Chicago, Ill. Filed February 24, 1886. Issued December 14, 1886.

354,440. Incidence-Window For Lighting Basements, Vaults, etc. Isidor Schoenberg, Baltimore, Md., assignor to the American Crystal Light Company, Boston, Mass. Filed April 24, 1886. Issued December 14, 1886.

354,456. Flushing-Tank. Charles W. Atkinson and Richard Murphy, Cincinnati, O. Filed April 13, 1886. Issued December 14, 1886.

354,467. Steam-Boiler. Patrick Fitzgibbons, Oswego, N. Y. Filed October 23, 1886. Issued December 14, 1886.

354,484. Metallic Roofing-Plate. George Patten, Clarksville, assignor to Moultrie Patten, Nashville, Tenn. Filed November 17, 1886. Issued December 14, 1886.

354,489. Heating-Furnace. Gideon A. Russell, Lyons, Iowa. Filed November 30, 1885. Issued December 14, 1886.

354,503. Ship's Water-Closet. Frank W. Cross, Washington, D. C. Filed July 6, 1886. Issued December 14, 1886.

354,508. Indicator for Reservoirs. Solomon Fraleigh, Newark, N. J., assignor of one-half to Alexander Bryant, New York, N.Y. Filed May 13, 1886. Issued December 14, 1886.

354,520. Gasoline or Oil Heating-Stove. Jesse Stubbs, Henry County, Iowa, assignor of one-seventh to George A. Stone, same place. Filed September 28, 1885. Issued December 14, 1886.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 11. } PUBLISHED EVERY SATURDAY.

NEW YORK, FEBRUARY 12, 1887.
LONDON, FEBRUARY 26, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

ANOTHER RAILROAD-CAR STOVE HORROR.

SCARCELY have the echoes of agony of the victims of cremation at Tiffin, Ohio, been stilled in death before another train-load of passengers in New England are burned to ashes by the deadly car-stoves and kerosene-oil lamps. Forty calcined shapeless trunks of human beings, the car axles and wheels, and a net-work of iron rods and bands were all that was left after the short space of one hour of two coaches and two sleepers on the line of the Vermont Central Railroad, near White River Junction, after the train plunged over the abutments of the Woodstock Bridge.

It is safe to say that more than one-half of these people would have recovered from the shock of the fall, and that the death and the roasting alive of twenty persons is directly the result of the railway companies' obstinately refusing for a number of years to adopt some safe mode of lighting and warming cars.

It is high time now that the Legislature of every State in the Union and the Federal authorities for the Territories at once pass laws for the abolition of fires and kerosene or the highly inflammable oils from railroad-cars.

We can well afford to be satisfied with the light of sperm or other suitable candles until electric or other safe lighting takes their place. In the matter of warming without fire in the car, however, we are not obliged to suffer any inconvenience. In fact, a change to any of the steam, hot-water, or chemical systems would result in increased comfort and health to the traveling public and increased facilities to the railroad by their being able to place four seats more in each car.

All this, however, is overlooked by the companies, and without legislation twenty years may pass before anything tangible will be accomplished. Some of the first-class roads will be driven by public opinion into making improvements, but there are others that must be forced into it by legislation.

Many railroad managers, we presume, are sincere in the thought that the amount of steam necessary for the warming of a train will be a serious drawback to the engine. In this they are mistaken, simply because they have had no experience; and with the hope of bringing to their attention how little the steam required for a train is, we quote from our editorial of the 29th of January, as follows:

"Two hundred square feet of pipe-surface is more than sufficient to warm a coach or sleeping-car. The condensation per square foot of heating-surface will never exceed one-half pound of water per hour, even under the severest conditions for direct radiation known to us. One-third of a pound of water is considered a high average in house-heating. But, assuming we take the highest possible average condensation, we have but to condense *one hundred pounds weight* of steam per hour per car, and for seventeen cars 1,700 pounds *weight* of steam, or, in other words, 1,700 pounds of condensed water formed in an hour for a train. If we consider, then, forty pounds *weight* of steam per hour as a horse-power in a locomotive (a low average estimate for many of them), we have 1,700 lbs. $\div$ 40 lbs. = 42.5 horse-power as that required for warming a train of seventeen cars—more than an average train even for the N. Y. C. & H. R. R.

"If we consider the horse-power of a passenger locomotive with $17'' \times 24''$ cylinders and $5'\ 6''$ driving-wheels, carrying about 140 pounds pressure of steam and running 60 miles an hour, we have $17^2 \times .7854 \times 70$ pounds mean pressure in cylinder $\times$ 1,220 feet piston-speed $\times$ 2 cylinders $\div$ 33,000 = (the enormous duty of) 1,175 horse-power. Let us assume, however, that only half this horse-power is developed (so we will be on the safe side in the calculation), as the point of cut-off may be shorter and the average speed only 40 to 45 miles per hour. At 40 pounds of water, then, to the horse-power, when developing only 587.5 horse-power, the locomotive must evaporate 23,500 pounds of water into steam, and as only 1,700 pounds of this water is required for warming the train of 17 cars, about only 7 per cent. of all the steam is required for warming a train."

Too much cannot be said on this subject at this time. We before conclusively proved that less steam was required for the warming of a train than was necessary to draw a single car forty-five miles an hour. We now add that with the increased room for seating when the stoves are done away with, a seven or eight-car train, as now made up, may do away with the one car, and the power saved in drawing that will warm the train and reduce the cost of warming from the engine to *nothing*.

The "Gold" system, the "Martin" systems and the "Emerson" system are all now in use—the Gold on the elevated trains of New York City and elsewhere; the Martin on the Cleveland, Columbus, Cincinnati and Indianapolis Railway and the Allegheny Valley and Pittsburg, and the Emerson on the Connecticut River Railroad. Then there are the Westinghouse and the Graydon systems.

Some of these systems have auxiliary boilers under or in cars that can be used in case of being snowbound, but any of them may take steam from the locomotive.

The running of steam-pipes, however, through cars to warm them is not patentable, nor is the taking of steam from the engine. Therefore there is nothing to prevent any master mechanic of a road from warming his cars, provided he does not use the special contrivances for joining cars, storing heat, or drawing off the water of condensation covered by the patents of those systems mentioned, or of others who have been experimenting to overcome practicable difficulties.

In an interview, Mr. Sloan, President of the Delaware, Lackawanna and Western Railroad, has said—

"That he sympathizes deeply with the President of the Vermont Central, who must bear the responsibility of this great disaster. No one could foretell upon what railroad executive the next calamity would bring reproach, merited or unmerited.'

In the face of what we know to exist in the matter of fireless cars, we are sure that reproach is now justly merited by any and all railroad managers who do not inform themselves of the methods at their command and who do not hasten to adopt them.

"A long train of cars crossing the mountains of Pennsylvania in winter," said Mr. Sloan, "could not be heated by steam. Even on the short trips made by the elevated trains in this city cars often become 'frozen'—that is, the water in the steam-pipes congeals—and several hours are required to thaw them out."

Here, again, he is misinformed, both as to the freezing on the elevated roads and on the mountains, for as long as steam is in the pipes and

the water of condensation allowed to run off they cannot freeze and do not freeze.

Mr. John King, President of the Erie, said: "Give me any efficacious method for heating cars without stoves and the Erie will adopt it."

This implies there are no efficacious methods of warming cars except the red-hot stove. If Mr. King will give any of the makers of systems for warming cars by steam first mentioned above the privilege of putting their apparatus on separate trains on the Erie Railway we are very sure they will be only too glad to fit them up at their own expense and allow him to try them to his own satisfaction. The Long Island Railroad is now fitting cars with both the Gold and Martin systems on trial.

Mr. Chauncey M. Depew is reported as saying in the New York *Herald* of February 8, that "the latest improvement in warming cars is the heater that drives hot water through iron pipes under the seats. The stoves are isolated as much as possible. All the Pullman cars adopt this method."

Nevertheless this is the method that fires all the sleeping-cars and parlor coaches. It was the method in use in the Wagner palace-car in which Senator Wagner lost his life, and, if our memory serves us rightly, it set fire to the train. The apparatus consists of a small boiler with a fire within it, and when it is wrenched from its fastenings it is no better than a stove, the hot coals flying among the débris and setting fire to them. Mr. Depew declared steam to be useless in trains of fourteen cars traveling long distances at the rate of fifty miles an hour. In this he has had no experience, because he has not tried it, and we know that in the light of the next five years he will be ashamed of his statement.

He says that while the cars are waiting in the depot for the locomotive to be attached they will be cut off from the heat-supply, and it will require half an hour to warm them again.

The answer to this is, lay steam-mains of small diameter between the rails in the Grand Central Depot, with flexible connections, and couple them the same as between cars and engine. The cry of freezing may be raised here, but this will not hold good if the pipes are properly arranged.

Another objection often raised is, what are passengers to do if the locomotive gives out and is snowbound? This contingency is contemplated by the Emerson, Westinghouse, and other systems in the use of an auxiliary boiler in the corner of a car or under it, or in the baggage-car, which can be brought into use temporarily and at a time when the train is not in motion.

The defence of the railroad companies at the present is to gain time and to put off a radical change that will cost money at the most distant day. Again, they are undecided as to the merits of the different systems offered, and want time to consider the question, naturally wishing to have the best. They know some experimenting must be done, and each is disinclined to have it done on his road. The example of the elevated roads and Colonel Hain's experience, however, ought to count for something, as the differences between his roads and the great trunk lines are not so great but that they may be overcome.

We are glad to see the New York State Legislature recognizing the public opinion on this matter, and instructing the Railway Commissioners, as they did last Monday, to investigate and report at the earliest day possible the means available for heating and lighting passenger-cars without danger of such accidents as this.

THE QUAKER BRIDGE RESERVOIR.

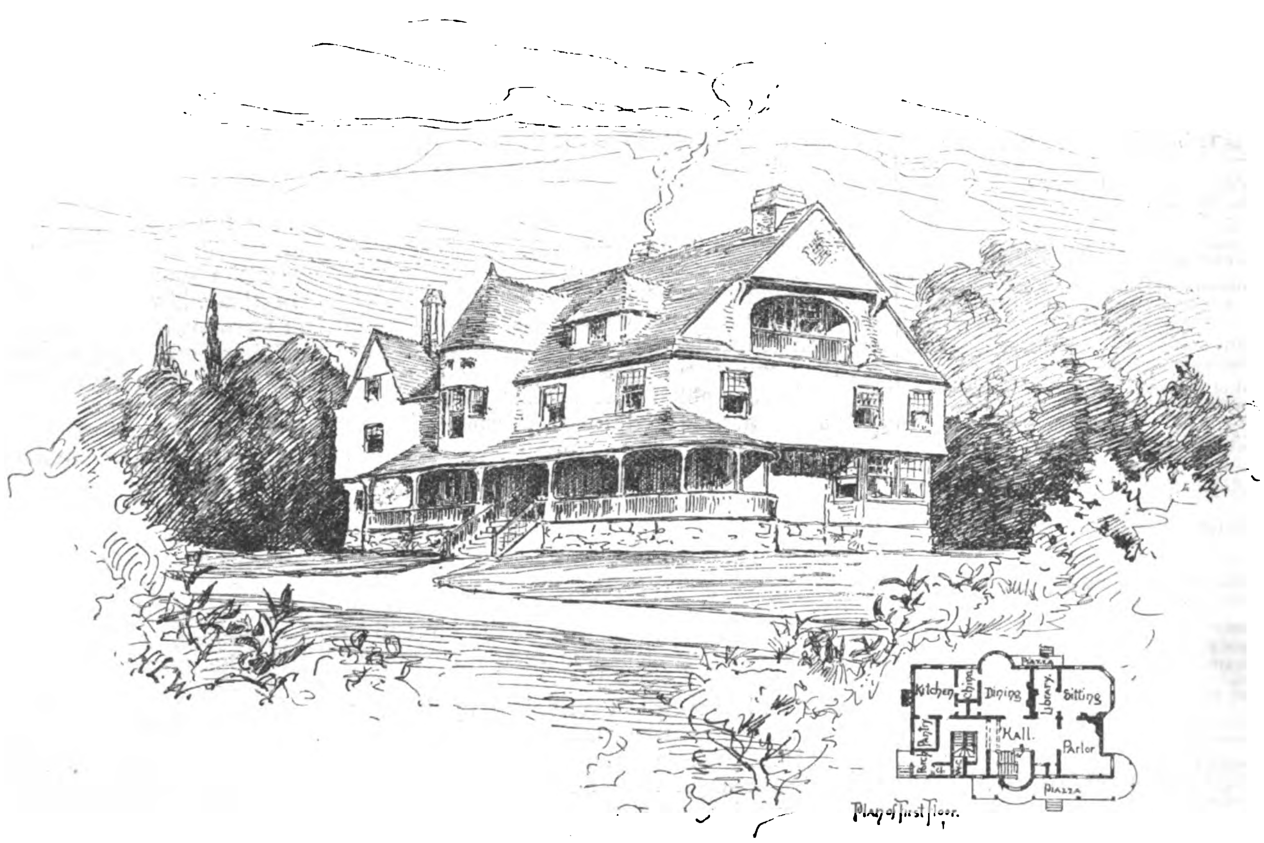
THE citizens of New York as well as the Aqueduct Commissioners are to be congratulated on the action of the last-named officials in deciding definitely to proceed with the construction of the Quaker Bridge Dam and Reservoir. Without the erection of this dam, the scheme of water-supply of which the New Aqueduct is a part would have been left incomplete in one of its most essential details, and the expenditure for the large tunnel would have been incurred without the possibility of utilizing so large a conduit or making the entire water-shed of the Croton River available for the collection and storage of water.

Mr. Church, to whom is due the credit of conceiving the project in its magnificent entirety, is particularly to be congratulated on the adoption of his scheme, in the face of persistent opposition, which we are willing to believe was based on honest though wrong-headed and ignorant convictions.

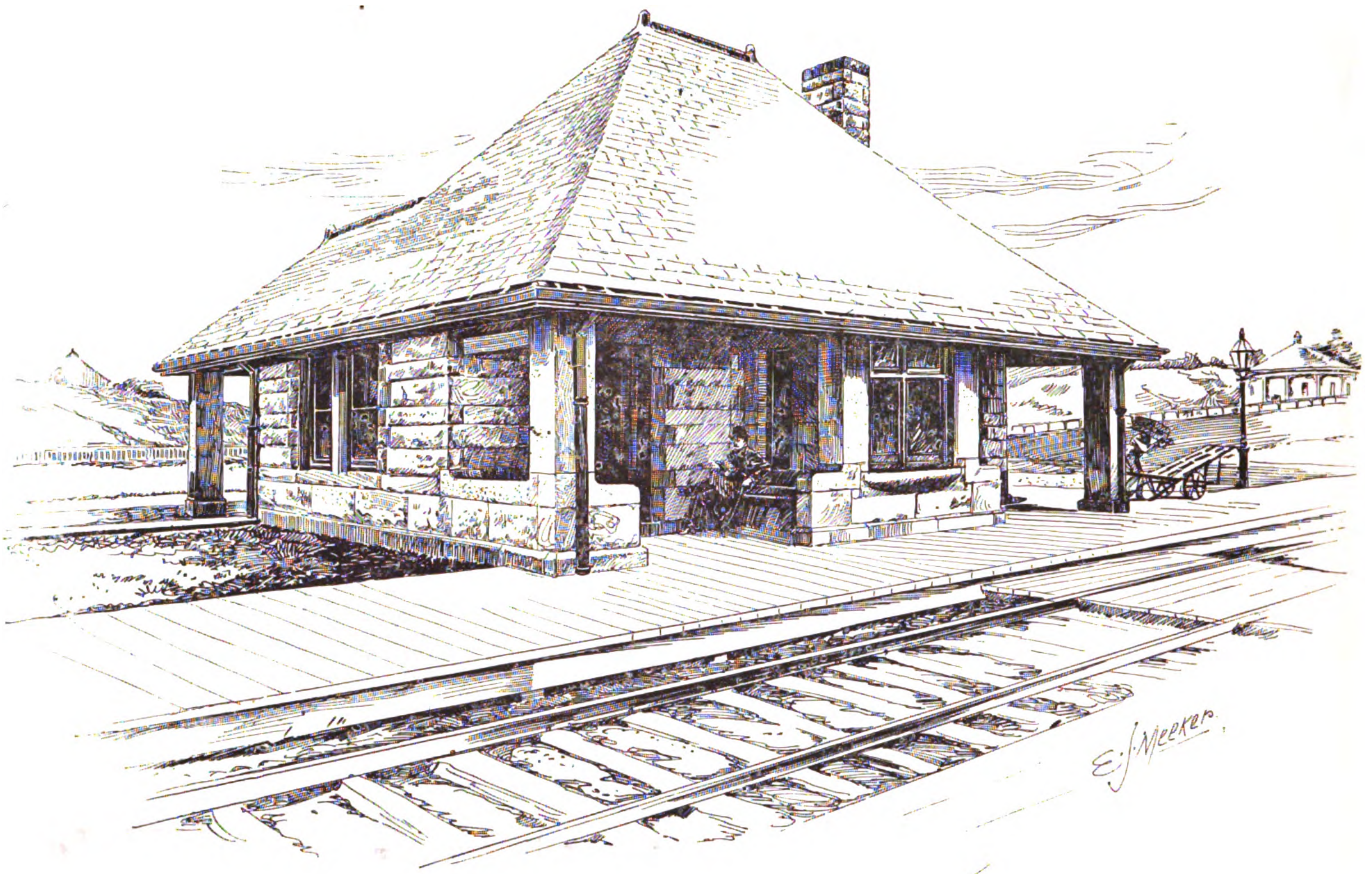
The detailed plans of the great dam are yet to be formally adopted by the commissioners. It is to be hoped that mistaken ideas of the theory and practice of hydraulic constructions may not interfere with the conclusions reached by careful and experienced civil engineers as to the ground plan, profile, and material to be adopted for this stupendous structure.

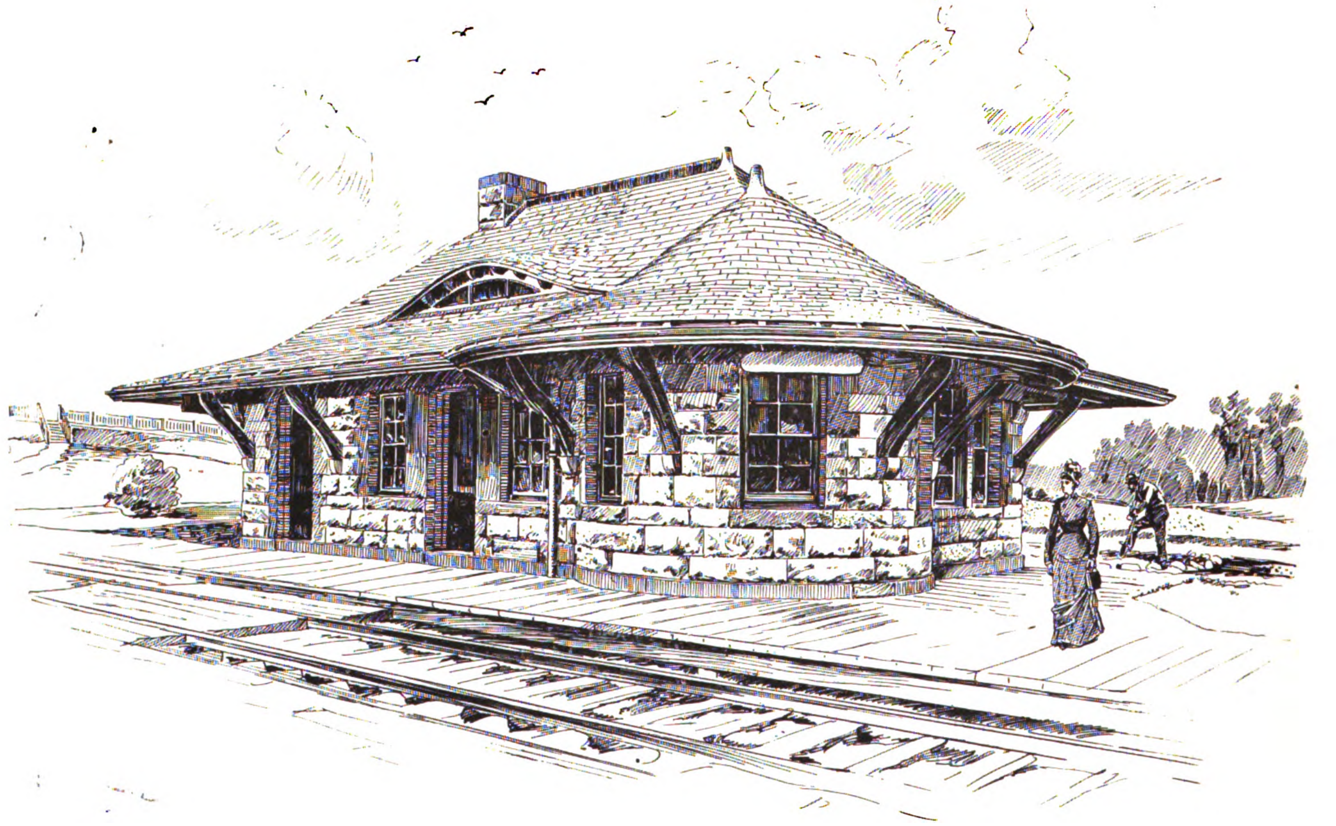
THE ARTHUR KILL BRIDGE.

THE promoters of the Arthur Kill Bridge having been beaten in a fair fight are now seeking to accomplish their ends by stirring up opposition among owners of small vessels. The owners of a considerable number of such craft have signed a petition in opposition to the long span recommended by the Board of United States Engineers on the purely selfish ground that the large tows now passing through this channel seriously impede the movements of their vessels. They would, therefore, have the channel divided so as to interfere with and cripple the most important portion of the traffic through it. It is possible that this may be considered a legitimate argument, but it will be hard to convince the thousands of coal consumers in this city that it is a fair one.



RESIDENCE OF MR. H. O. UNDERWOOD, AT BELMONT, MASS.—HARTWELL & RICHARDSON, ARCHITECTS.





THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

STATIONS ON THE BOSTON AND ALBANY RAILROAD.

H. H. RICHARDSON, ARCHITECT.

OUR BRITISH CORRESPONDENCE.

Road Repairing to relieve Distress of the Tottenham Poor—The Sanitary Regulations of Buildings Bill—Death of Colonel Francis Bolton—Sale of "Old London Street"—Landlords and Insanitary Houses—Electric Lights in the Isle of May Light-House.

LONDON, January 26, 1887.

THE Tottenham Local Board has set an example which might be followed with advantage by other boards in the present state of the labor market. Recognizing the distress that exists amongst the laboring classes, which is, of course, emphasized by the time of the year, the board has resolved to put their roads in a much-needed state of repair, and have applied to the Local Government Board for the authority for raising a loan for that purpose. Labor being so cheap at the present time, the ratepayers of the district will have cause to thank the board for their foresight in taking advantage of existing circumstances.

At the usual monthly meeting of the Sanitary Assurance Association, London, the draft of the proposed bill for Sanitary Registration of Buildings was under further consideration. As previously stated, the bill provides for the qualifications of certifying officers and penalties for incorrect certificates. It proposes that the registration shall be compulsory in the case of schools, hotels, asylums, hospitals, and ordinary lodging-houses.

The death has been announced of Colonel Sir Francis Bolton, late Water Examiner of the Metropolis. Sir Francis Bolton will probably be best remembered in connection with the admirable exhibition of water-works apparatus, appliances, and systems at the Health Exhibition, which was under his organization and personal superintendence.

I notice in connection with the realization for the buildings of the International Exhibition at Kensington, that the picturesque "Old London Street" has been sold in lots to one purchaser, and has fetched the small sum of £180 ($864). It is, of course, not to be expected that any building materials will fetch an amount approaching the original cost, but it might almost have been looked for that such an interesting architectural reproduction as the "Old London Street" would have sold for rather more.

A legal decision of very considerable general interest is reported from Nottingham. A firm of brewers sued a tenant for rent of a house in which she had resided. The defendant admitted the debt, but alleged that the house was unfitted for habitation, owing to defective sanitary arrangements, and presented a counter claim for expenses incidental to the death of a child, alleged to have resulted from illness due to a polluted atmosphere. The judge found for the plaintiff on the question of rent, and for the defendant on the counter claim.

The first case of adoption of the electric-light for use in lighthouses on the coasts is reported from the Firth of Forth, where the Commissioners of Northern Lights have introduced electricity into the lighthouse on the Isle of May. The light is stated to be equal to about 3,000,000 standard candles. Two 16-horse-power engines, driving two dynamos, are provided. As a rule one engine is auxiliary. The distance between the light and the engine-house is some 900 feet, and the current is conducted over this distance by 1-inch copper rods placed in a groove in a low cement-rubble concrete wall. SAFETY-VALVE.

THE RAILROAD JUBILEE.

PLANS for the Jubilee Exhibition Palace in Paris were decided upon some time since by M. Montant, President of the committee, and its construction in the Bois de Vincennes, upon a site granted by the city of Paris, is now going rapidly forward. The exhibition is highly spoken of by the French press, and its opening in May next is looked forward to with great interest. The Commissioner-General for the United States is Mr. John W. Weston, 230 La Salle Street, Chicago.

THE plan of putting together water-pipe on the ice between Green Bay, Wis., and Fort Howard, and then sinking them, did not prove to be a success. After being sunk the joints leaked, and a coffer will probably have to be built to complete the work.—*Davenport, Iowa, Democrat.*

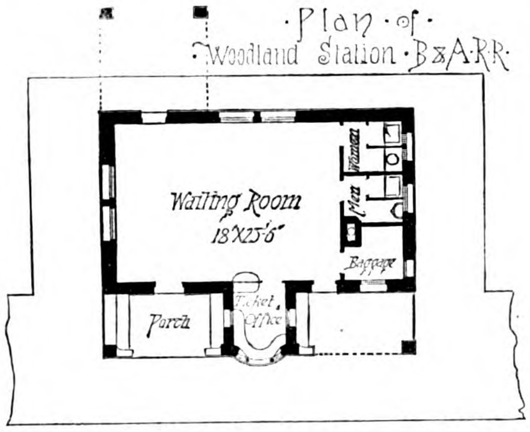
A STATE Chapter, for Kentucky, of the Western Association of Architects, is forming at Louisville. Mr. H. P. McDonald is the organizer.

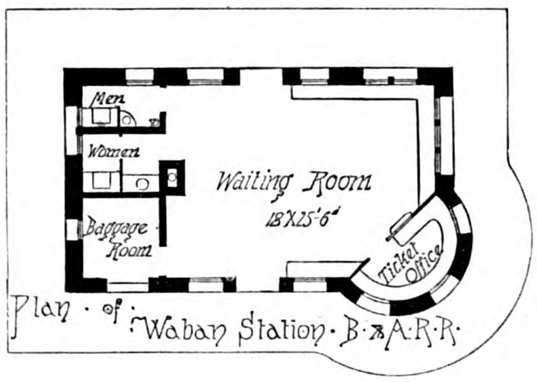
ENGINEERING & ARCHITECTURE

OUR SPECIAL ILLUSTRATION.

DEPOTS AT WABAN AND WOODLAND, MASS.—H. H RICHARDSON, ARCHITECT.

THE subject of our special illustration this week are the stations at Waban and Woodland, Mass., on the Newtown Circuit of the Boston and Albany Railroad. The exteriors of the buildings are of brick and Milford granite,





with Longmeadow sandstone trimmings, and slate roof. The interior finish is quartered-oak doors, architrave seats, etc. The ceilings are of clear spruce. The late H. H. Richardson, of Boston, was the architect.

The upper view shows the station at Woodland, the lower view the station at Waban.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A RESIDENCE AT BELMONT, MASS.—HARTWELL & RICHARDSON, ARCHITECTS.

THIS house is the residence of Mr. H. O. Underwood, at Belmont, near Boston, Mass. It is a frame house, covered with shingles. In the interior the sitting-room is finished in oak; all the rest of the house is finished in white-wood. The dining-room has a high-paneled wainscot and sideboards built in on either side of the fire-place. The fire-place in the hall is of brownstone. The cost of the house was $11,900.

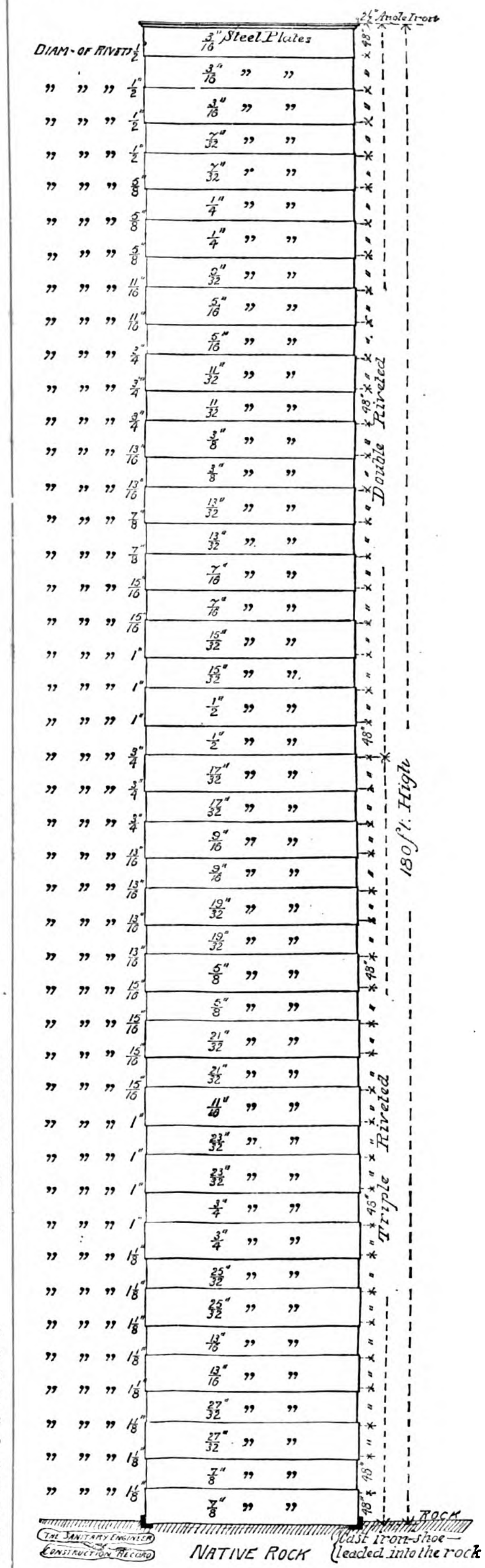
The architects are Messrs. H. W. Hartwell and William C. Richardson, of Boston, Mass.

THE SANDUSKY STAND-PIPE.

WE present herewith a drawing of the stand-pipe for the Sandusky water-works, and we illustrate it as an example of a work that has stood and done good service. These works were constructed about ten years ago, water being taken from a bay or "cove" in Lake Erie at a point where it is free from contamination by sewage and about 1,800 feet from the pump-well. It is pumped directly into a stand-pipe by two Worthington engines—one a compound duplex condensing engine, with cylinders 25x36 inches and 43¼x36 inches, and with a capacity of 3,000,000 gallons in twenty-four hours, the other, a duplex non-condensing engine, with cylinders 24x26 inches, and of 2,000,000 gallons capacity under the same conditions.

The four boilers are of the return tubular type, each sixty-three inches in diameter and eighteen feet long, with sixty-five 4-inch tubes.

Water is taken into the 3-foot diameter wrought iron influent pipe through a crib in the lake having an internal diameter of twenty-five feet and an outside diameter of forty-five feet, extending from the rock below to six feet above water-level. It is built of double walls of timber filled in with broken sandstone. The influent pipe was laid in lengths of ninety feet, put together on scows, the lengths after sinking being bolted together through the flanges by a diver. The pump-well is a rectangle 8x22 feet, excavated in the rock to a depth of twenty-one feet and brick-lined.



SANDUSKY STAND PIPE.

The stand-pipe is twenty-five feet in diameter and 180 feet high, with a storage capacity of 661,000 gallons.

In the centre of the main pipe is an interior auxiliary stand-pipe for fire service 3 feet in diameter and 230 feet high, with valve connections for immediate change in the connection with the pumps. The interior pipe is not shown in the drawing.

The riveting is triple in the vertical joint for about one-half the height, and double above that. The material is low carbon steel of a tensile strength of about 67,000 lbs. per square inch, with steel rivets of 60,000 lbs. strength per square inch.

The tower rests on bed-rock, and is anchored to it by 12 rods 1½ inches in diameter each, riveted to the second row of plates in the pipe. The rods penetrate eight feet into the rock, and are fastened by foxing at their lower ends. The bottom course of the pipe is leaded into a cast-iron shoe constructed in segments which are joined by flanges and bolting. This is placed in a groove cut in the rock, and leaded and calked to a water-tight joint.

The pressure ordinarily maintained is 50 to 60 pounds, but it can be increased very quickly to nearly 100 pounds.

It is found that the stand-pipe answers an admirable purpose as a supply-reservoir, so that the average running time of the engines is about eight hours per day.

No difficulty has been experienced from freezing, notwithstanding that at one time the thermometer averaged but twenty degrees above zero for sixty days, and for seven days averaged from zero to 18 degrees below it.

The chief engineer from whose designs and under whose direction the work was done was J. D. Cook, of Toledo, O. The superintendent of the water-works was E. Graves.

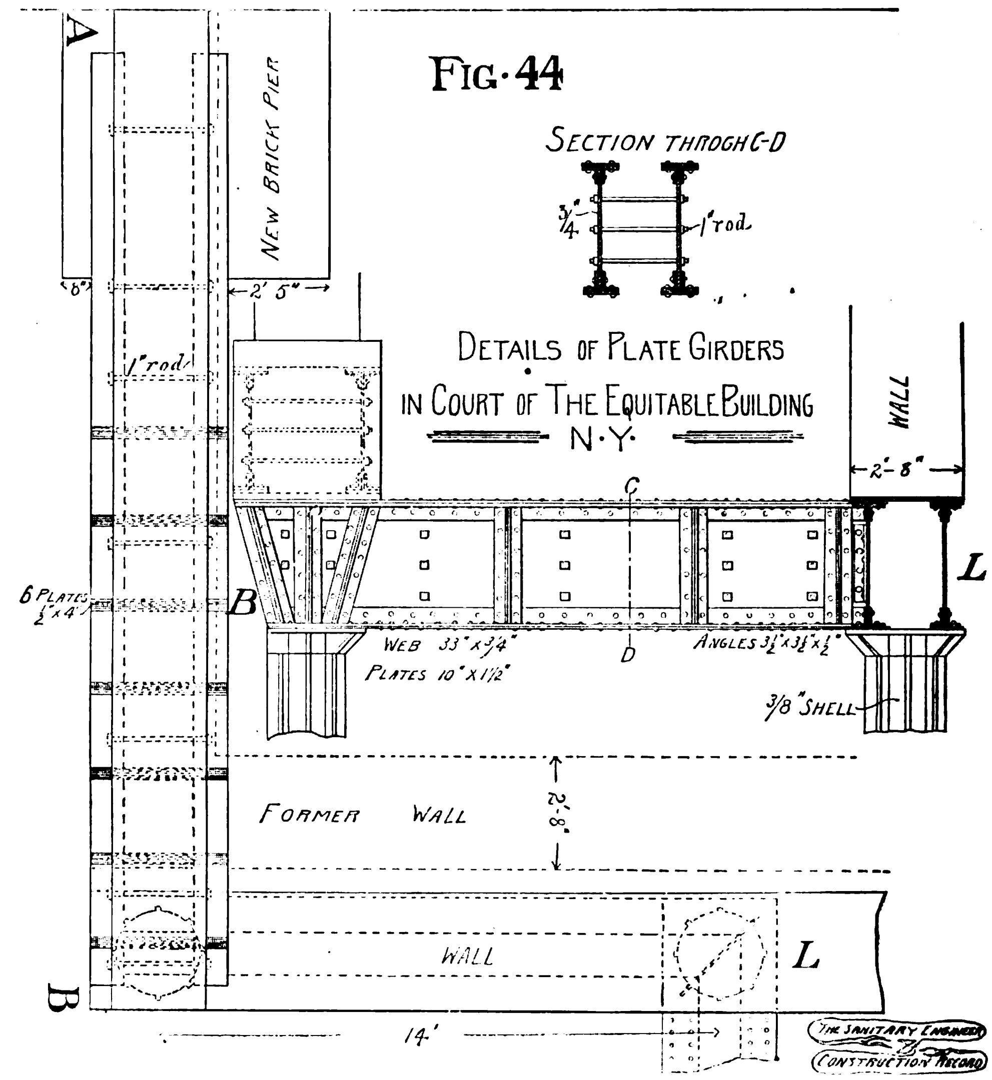
The contract price for the construction of the stand-pipe was $46,927, and it was built by Messrs. J. & T. McGregor of Detroit. The pumping machinery was contracted for by Mr. H. R. Worthington at $32,500, and the total cost of the works was about $368,000. Other contractors were H. R. Smith & Co., of Columbus, for the iron pipe; Hockstadter & Hartman, of Poughkeepsie, for laying the pipe; R. D. Wood & Co., of Philadelphia, for the hydrants; Klotz & Kromer, of Sandusky, for the valve work; John Carr, of Sandusky, for the boiler house; N. H. Moore, of Sandusky, for the influent pipe.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XI.

(Continued from page 233.)

THE weight of the Equitable Building and contents as it stood before the changes were made was estimated at 60,000 tons, and the shoring of the main interior brick walls was a work requiring great care and judgment. The old walls were left standing as long as possible, and wherever the new piers could be built and bonded into the old work this was done before the old walls were disturbed. In this way the angle of the "main court" of the new building intersecting the curved wall of the old building and the pier adjacent on the Cedar Street side were carried up two stories and allowed to consolidate for two months or more before the old wall was removed. Mean-



FIG·44

SECTION THROUGH C-D

DETAILS OF PLATE GIRDERS IN COURT OF THE EQUITABLE BUILDING N·Y·

time the remaining walls were brought up and the whole building was in a much safer condition for shoring the upper stories and cutting down the wall, altogether some seventy feet in length. We wish to commend, also, the method pursued in this building of putting up the interior iron-work and the hollow-tile work of the floors for from one to three stories in advance of the exterior masonry. In this way the settlement under the interior piers kept pace with that of the exterior piers, and there was little chance of any change after the completion of the work.

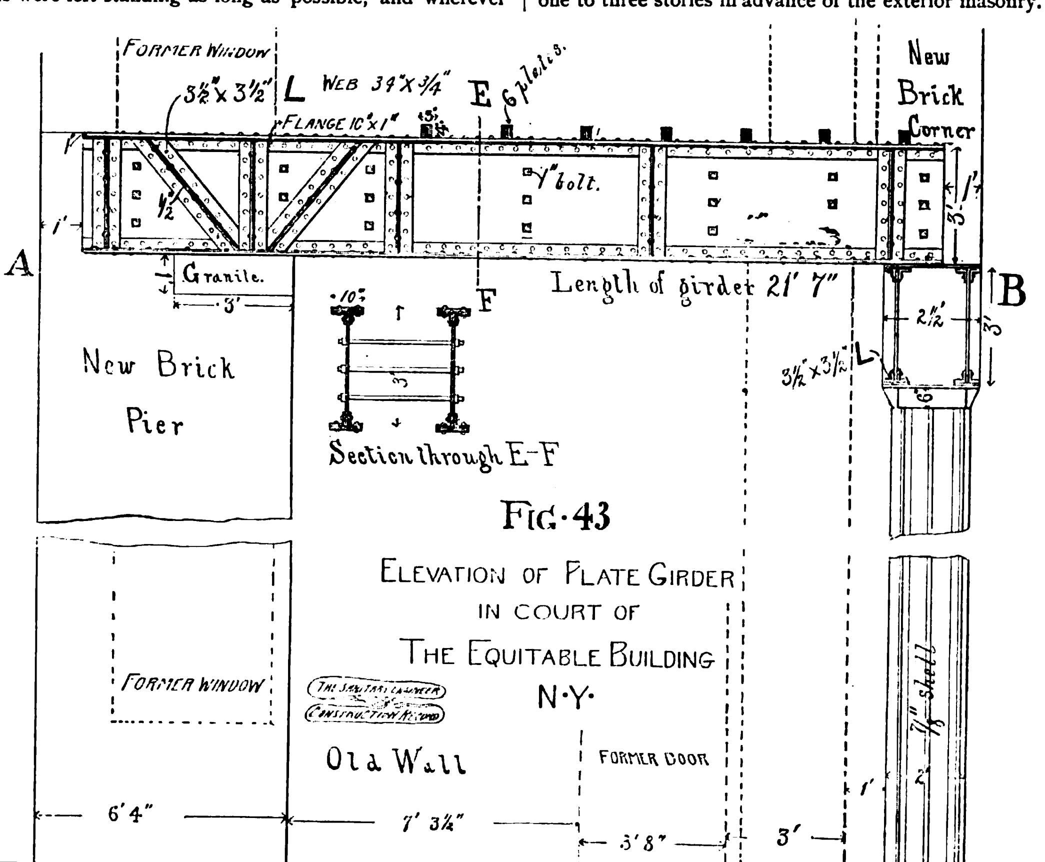
One of the most interesting pieces of work was at the portion lettered A B C in the plan, published on page 232. The old wall B C in dotted lines was to be removed and the old wall A B to remain. At the same time to make room for the wide passageway previously mentioned it was necessary to remove them both in the lower story. The change had also to be made without disturbing the tenants in the room enclosed by the angle. Figures 43 and 44 show the plan adopted to secure these results.

The former window shown in Fig. 43 was bricked up, and the brick-work thickened so as to make it suitable for a pier. Two plate-girders were then built of the section shown, and grooves four inches deep were cut on each face of the wall A B, allowing the girders to have their webs brought flat against the wall. They were then secured in place by 1-inch through bolts. As an additional precaution holes were then cut through the wall, and a series of thin plates four inches deep inserted, as shown, to more fully transfer the load to the girders.

The columns were then erected at the angles, and the angles B C in general plan, or B L in Figs. 43–44, and the girders B L, etc., put in place. The new wall on top of girder B L was then built and thoroughly bonded with the old wall A B by cutting out bricks and by suitable iron clamps. After the cement was well set, the portion B C of the old wall and also that under girder A B, between the column at B and the pier, were cut out.

The removal of the old wall B C made all the 10-inch iron floor-beams formerly resting upon it too short by about two feet. As their removal would have caused great inconvenience, and, probably, more expense, they were lengthened by partially removing the arches of the floor, placing a 12½-inch beam each side of them, and bolting through as shown (Fig. 45, p. 261). The same method was pursued in lengthening the beams in the topmost stories, which were too short after the roof was raised.

(TO BE CONTINUED.)



FIG·43

ELEVATION OF PLATE GIRDER IN COURT OF THE EQUITABLE BUILDING N·Y·

THE Contractors and Builders of Hamilton, Ont., had their first annual supper January 31, John Webb, President of the association, at the head of the table.

PRELIMINARY REPORT OF THE CHICAGO COMMISSION ON DRAINAGE AND WATER-SUPPLY.

THE preliminary report of the Chicago Drainage and Water-Supply Commission, consisting of Mr. Rudolph Hering, Chief Engineer, and Messrs. Benezette Williams and Samuel G. Artingstall, Consulting Engineers, was presented to the Mayor on January 29, 1887, and is well summarized by the *Inter-Ocean*, as follows:

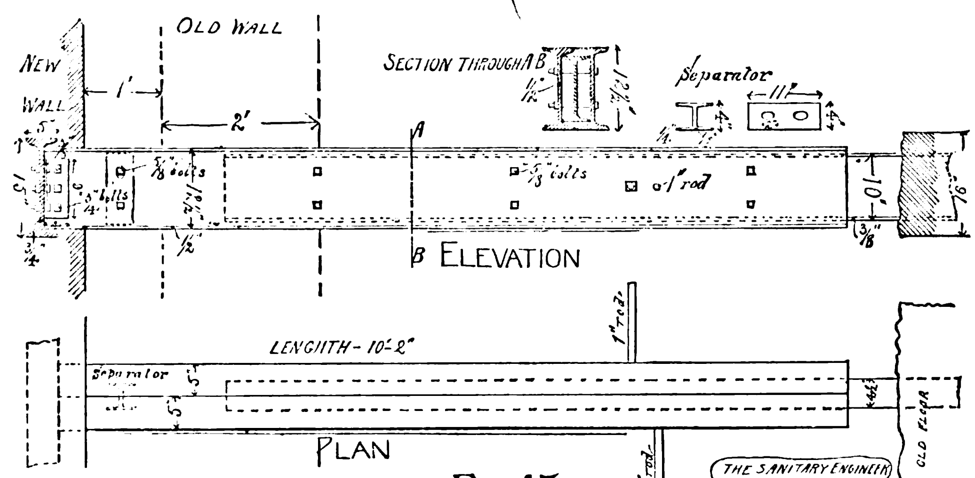
The present report is made simply with the view of indicating the character of legislation required to carry out any project that might be determined upon, leaving to a later date the presentation of detailed features of the scheme. As the water-supply must be taken from the lake, it became evident that both its pollution and the objectionable condition of the rivers should be prevented by a better disposition of the sewage, and therefore the latter question constituted the main object of the investigation. But three methods of disposing of the sewage were deemed worthy of consideration—namely, discharging it into the lake, on to the land, or into the Desplaines River.

It was taken for granted that Chicago and its adjoining suburban towns will have to dispose of their sewage so that the water-supply for the community residing near the lake, from Hyde Park to Evanston, will be guarded against pollution by sewage. The probable forecast of future increase of population was then arrived at by considering the rates of increase elsewhere.

With the view of ascertaining the effect of discharging the sewage into the lake experiments were made to ascertain the trend of the current, and along the shore of Cook County it was found to be toward the north. It was decided that if the sewage was thrown into the lake eventually the water-supply would be polluted, and would have to be brought from Gros Point in large conduits to the several pumping-stations. The disposal of the sewage by distributing it on the land was deemed impracticable on investigation, and its discharge into the Desplaines River was next considered. The question of the best point of discharge was taken up, and in order to arrive at a satisfactory solution the fluctuations of the lake since last spring were taken automatically.

Comparing the projects, the commission arrives at the conclusion that to throw the sewage into the lake from a population of 2,500,000 and taking the water at Gros Point would cost $37,000,000, with an annual expense for interest and operation of at least $2,000,000, and an immediate investment of $20,000,000. To dispose of it by filtration on land would require an investment of $58,000,000, with an annual expense of $3,000,000 for interest, pumping, and maintenance, and an immediate investment of about $34,000,000. For the Desplaines River project the estimated cost is for the main district between $20,250,000 and $24,550,000; for the the Calumet district between $2,850,000 and $3,400,000; the annual cost, including interest, is estimated at about $1,300,000. To carry out the latter project works costing between $5,000,000 and $5,500,000 will be needed.

The report is quite long and contains much interesting matter, and will be more fully noticed in our next issue.



THE EQUITABLE BUILDING N.Y. FIG. 45 METHOD OF SPLICING BEAMS

AT the meeting of the Worcester, Mass., Society of Engineers, on February 4, the principal feature of the evening was the reading of a paper by Mr. E. K. Hill on the history and development of steam-heating. At the next meeting, on March 4, Mr. A. J. Marble will read a paper on Public Parks.

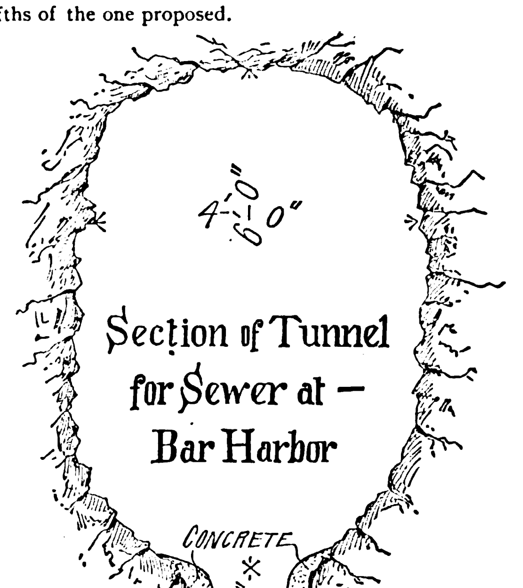
THE SEWER SYSTEM IN BAR HARBOR.

A SYSTEM of sewers having been devised for Bar Harbor by Mr. Ernest W. Bowditch, the citizens at a town meeting, held on October 16, adopted it and ordered it put into execution. As it seemed to some of the citizens whose lands would be affected by it, that a better plan for the outfall might be adopted, they employed Mr. Stevenson Towle and Mr. William E. Worthen, both of New York, to examine the plan and give their opinion upon it.

The report of these gentlemen, dated December 16, has just been published. It seems from this that the plan was designed as a separate system to carry off the sewage of a population of 50,000 inhabitants, excluding all rainfall. The outlet proposed by Mr. Bowditch made a long detour, crossing private grounds, requiring blasting to considerable depth much of the way and in some places to twenty-four feet. The chief objection to the scheme was, however, the extreme flatness of the sewer, the grade being for some 4,000 feet but 1 in 666.

The report states that the greatest summer population at present is but about 8,000, for which the twenty-four inch outlet pipe provided is too large, and "unless some means of flushing be provided, there will be, from the sluggish currents, deposits of solid matter which will breed poisonous gases, and by their accumulation constantly retard the flow. In our opinion in pipe of this size, where the discharge is not likely to fill more than a small fraction of the section of the pipe, the grade should be never less than is sufficient to produce a velocity of two feet per second, which is not done on the low gradient of Mr. Bowditch's main sewer, except when it is running in depth over one-fourth of its diameter, which would require a discharge of a population of over ten thousand. The flow of sewage from your variable population would at all times be almost stagnation."

The report recommends two outlets fifteen inches in diameter, much shorter, and costing together but about two-fifths of the one proposed.



Section of Tunnel for Sewer at — Bar Harbor

They accomplish this by tunneling, and suggest, as the most economical size of tunnel, one 4x6 feet with a concrete sewer invert in the bottom eight inches deep (see section annexed). This they say can be built at a cost of $5 to $8 per running foot, and will do away with much of the nuisance of an open cut the entire distance. An additional reason for the proposed outlets is that the sewage will be less apt to be thrown on the shores and cause a nuisance. The estimated saving in cost is $37,200, in addition to possible land damages of large amount.

IRON BRIDGES WITH CONCRETE FLOORS.

AT the recent meeting of the Connecticut Society of Civil Engineers, a paper, with the title above, was read by Mr. B. K. Field, Treasurer and Secretary of the Berlin Iron Bridge Company.

The author recommends such bridges for spans up to 50 feet as an economical substitute for stone arch-bridges, and for the additional reason that they furnish a freer waterway.

Above 50 feet he recommends iron truss-bridges, but it is sometimes necessary, where the depth available for plate-girders is limited, to substitute trusses even in spans less than 50 feet; since the depth of a plate-girder should be from one-eight to one-tenth the span. The concrete and iron floors adopted by the author are described as follows:

"A system of transverse girders or floor-beams, together with longitudinal girders or stringers, connect the main girders or trusses and leave spans of from 36 to 48 inches between the stringers. A corrugated iron arch with a rise of from 6 to 10 inches, according to the span, spans this distance. On some of the older bridges buckle-plates were used, but they have been almost entirely superseded by the corrugated iron arch. The buckle-plate being practically flat does not have the stiffness of an arch, and so, by its spring, causes concretes, with which it is covered, to crack, thereby destroying the concrete and allowing the water to settle on and rust the iron. Iron must be protected from the water settling upon it if we wish to prevent rust. The Girard Avenue Bridge in Philadelphia is a very good example of what rust will do. The buckle-plates are covered with gravel and sand, on which the granite blocks are laid. The water has trickled through the interstices between the granite blocks, and now, after about eleven years of service, these buckle-plates, ¼-inch thick, are rusted through in many places.

"Concrete is filled over this arch so that it shall be from 4 to 6 inches thick on the crown of the arch. In this way a series of stone arches is obtained which adds materially to the stiffness of the structure. The arches may be covered with a concrete made of gravel and coal-tar, which makes a base preferred by some. Over this cement-concrete, macadam, asphalt, granite block, or any other material that will answer as a wearing surface may be used.

"Concrete bridges are proportioned for loads varying from 150 to 250 pounds per square foot, depending on the span, location, and material composing the wearing surface. The writer had charge of the construction of a concrete bridge connecting Westerly, R. I., with Stonington, Conn. The bridge consists of four 40-foot spans with a 30-foot roadway, and rests on fifteen cylinder piers, of the style known as the Cushing pier. Each pier consists of a wrought-iron cylinder 42 inches in diameter and varying from 10 to 12 feet long. In each cylinder were driven a cluster of three white oak piles; the piles were cut off 12 inches below the top of the cylinder and were drift-bolted together. If desired, the piles may be sawed off at the surface of the water, or at any other point below the top of the cylinder. The cylinder above the top of the piles may be filled either with cement-concrete or with stone-work, so that the weight upon the pier may be equally distributed upon the piles. The cylinder was then filled with cement-concrete well rammed. In order to secure a firm foundation and to prevent undermining, the bottom under each cylinder was excavated by a submarine diver, and when the cylinder was placed in position the up-stream side was well rip-rapped.

"Usually the cylinders stand alone, but when they are very high it becomes necessary to brace one cylinder to the other with wrought-iron braces.

"The especial attention of the engineers of this associaiton is called to this economical substitute for stone piers, as durable, in fact, as stone piers themselves. The Cushing pier is especially adapted to places where the waterway is limited, as the area they occupy is a small percentage of the area occupied by stone piers. Also in localities where piles are subject to the ravages of the sea-worm (*teredo*) and in deep and swift water where the erection of masonry would be too slow or too expensive."

The remainder of the paper is devoted to cement-concrete and methods of mixing.

CONTRACT PRICES FOR THE PARIS EXPOSITION, 1887.

ON pages 271 and 272 of Vol. X., 1884, of THE SANITARY ENGINEER AND CONSTRUCTION RECORD will be found an account of the mode of letting contracts on French public works, which is similar to that used in Belgium, Italy, and other European countries.

The different large cities of France have a detailed schedule worked out for all kinds of labor, and work liable to be called for on public and even private work. These schedules are based on the average amount of work performed per day in the different trades, and new schedules are worked out from time to time as the prices of materials and labor come to vary very much.

Estimates of quantities are made out for every job to be let by contract, and the estimated cost is worked out with these quantities and the prices of the official schedule of prices or *Serie*.

When bids are sent in they are in the form of more or less discount per cent. on this total estimated cost, so that the final cost of the contract as awarded is immediately obtained by figuring this discount and subtracting it from the original estimate.

In applying this to the work itself this same discount applies to every item of the schedule whatever the actual quantities of work may be done; and also in settling for all extras, the price is figured from the *Serie* with this same discount.

The published *Serie* is worked out for every different item of each trade. But when any large work is being let it is very common for the engineers to make up from the series a special schedule for this particular work, wherein the items are united together, as for items of excavation; one single price will be worked up to include teaming, picking, shoveling, ramming, dressing, timbering, etc., whereas the regular series has separate prices for each item.

We take from *Genie Civil* list of prices on which the estimates for earth-work and masonry for Paris Exposition of 1887 are based, and on which all bids are to be received. The percentage of discount of each bidder to apply to each and all the following items:

N. B.—Five francs equivalent to $1.

	Francs.
1. Excavations of earth of all kinds, over two metres wide, and for all depths, including throwing up on bank, on stagings, raising, loading, transporting by barrow or cart within the enclosure of the contract, spreading in fill, ramming, leveling up, including also all necessary scaffolding, bracings, pumping, and disinfecting if required, and all accessory labor. Per cubic metre	1.80
2. Excavations in trench, for all depths, for walls, arches of any size, including all facing up of sides and bottoms, centres for arches, well rammed with sand and finished off to line with plaster, including also refilling, ramming, leveling, raising, throwing up, loading, transporting, pumping, bracing, staging, etc. Per cubic metre	2.15
3. Excavation to all depths of wells of from one to two meters in diameter, circular or oblong, materials raised by engine or by pails, transported, spread, and rammed as above. Including also all pumping, disinfecting, dressing up sides and bottom, bracing, staging, sheeting, bents, etc. Per cubic metre........................	4.00
4. Beton (concrete) in hydraulic lime-mortar of Beffes de Ville sous la Ferté, or analagous lime at the choice of the architect, with river-sand and gravel. Mortar to be formed of two parts powdered lime and five parts sand. Beton to be formed of two parts of above mortar and three parts broken stone, well washed, including lowering into work, ramming in layers of 0.20 m. pressed into vertical parts. Per cubic metre........................	20.00
5. Masonry in new Meulière stone, bedded in hydraulic lime-mortar of same quality and composition as described above, for foundation-walls and basements, including lowering, filling, jointing and pointing faces, all recesses, jambs, sills, corners, etc. Per cubic metre........................	26.00
6. Masonry, same as above for vaults, arches in foundation on earth centres specially prepared as described in No. 2; including all other necessary centres and sills. Faces perfectly filled and jointed and pointed. Per cubic metre....	27.00
This includes all masonry between the intrados of arch and the level line top of extrados—that is, the filling on the hips of arches will be included in the measurement of the arch masonry.	
7. Cement plastering over masonry, first quality Boulogne or analagous cement at the choice of the architect, four centimetres thick, well dressed and smoothed off horizontally to receive foot-plates of columns or metallic piers, including leveling up of masonry previous to laying the plastering. Per square metre........................	2.90
8. Arches and small or large vaults in Vangirard bricks, first quality 0.11 m. thick, laid in extra burnt cement of Paris basin, joints flushed full. For filling in between floor-joists, etc., with under face to be left apparent, including jointing, and filling up over head with beton, leveled off for receiving iron-work. Per square metre measured on intrados....	7.00

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

No. II.

(Continued from page 234.)

THERE is another cause for the disintegration of stone, which, while it is not very powerful, contributes its share in weakening it, and that is the efflorescence upon or the formation within the stone itself of more or less soluble salts, which are generally sulphates. These, by exuding from the surface, and crystallizing both within and outside of the stone, must of necessity cause a pressure toward the outside, and thus, by producing more or less of a separation in the grains of the stone, tend to disintegrate it. In the modern haste to finish things rapidly, and the anxiety to produce cheap materials, almost everything is done with a view to gain money or to save time, while thoroughness and durability are neglected. The lime of which the mortar is made is burned in direct contact with a refuse fuel, and this contains very frequently considerable quantities of iron pyrites, from which sulphates more or less acid are produced, which are retained in the lime, and as these sulphates are usually more or less soluble, they either effloresce from the mortar, making it weak and causing it to dissolve out from the joints itself, or infiltrate through the stone and crystallize there, some of the substances coming to the outside as a white stain.

There is, independent of this cause—imperfect work in the manufacture of brick—the formation of the sulphates of alumina from the presence of pyrites in the clay. They exist in it much more frequently than is generally supposed. This would form an alkaline sulphate of alumina, containing either potash or soda, and tend to dissever or weaken the brick. Washing these efflorescences off with sulphuric acid, as is frequently done on brick buildings, or the cleaning of the surfaces of limestone in the same way, still further tends to increase the decomposition and consequent weakness, unless the stone or brick be immediately washed thoroughly with hot water, which, however is never done. The use of acids to cleanse any stone or brick-work is objectionable. There are a number of substances which can be used for this purpose which produce no injurious effect on the brick or stone, and are more effectual, while being quite as cheap as any acid. In underground work the presence of any considerable amount of pyrites in clay should cause extra precaution to be taken with the structure. The brick-work of the first tunnel under the lake at Chicago was crushed in several places, and the tunnel shoved out of place in many more, by the decomposition of the pyrites in the clay, when the work was allowed to remain exposed to the air too long before filling the space between the brick-work and the clay.

The corroding effect of sand carried by the wind at high velocity has a very decided influence in producing the disintegration of the surfaces of building materials. This is evident on the surface of every building which is exposed to the dust of cities and swept by the prevailing winds. My attention was first called to it by being asked to study the reason of the defacement of the inscriptions on certain tombstones of historic interest some years ago, which seemed to be produced by no assignable cause. These tombs were placed just where they received the dust blown by the city winds, through an opening quite narrow, but where the action was constant whenever the winds were of any great velocity. To ascertain exactly what the effect of the power of sand might be when driven by wind, I undertook a series of experiments on the abrasive power of sand, with the sand blast. These were made upon ordinary stones, commencing at first with the softer varieties. I very soon found that there was no stone of hardness sufficient to resist the power of the blast even for a few minutes. I then tried hard white cast-iron and hardened steel, but found that they had only a small resisting power, and wishing to ascertain exactly what the force of the blast was, in terms which would be readily understood, I commenced a series of experiments on the minerals which compose the scale of hardness. I very soon found that there was no use in experimenting on stones less hard than the topaz. The surface abrasion was so rapid that they were in a very short time reduced to powder, so that there was no opportunity of examining critically the effects of the blast. I very much regret that I did not have an opportunity of examining the effect of the sand blast in regard to the toughness of materials acted on, as well as hardness, but the time during which I was permitted to use the blast was very limited, and I have never had the opportunity of continuing my experiments. I, however, learned in the course of them, that on soft materials which were elastic, the effect of the blast was either reduced to zero or was very much diminished. It is well known to those using the sand blast that very hard substances may be entirely protected from the effect of the blast by using either a rubber coating or a film of some soft metal like tin, which, from its elasticity, will throw the grains off, while the harder surfaces will be abraded by them. This is no doubt the reason why soapstones and other varieties of very soft rocks, when they do not include within them minerals like pyrites, which, by their decomposition, cause them to disintegrate, have resisted atmospheric influences for very long periods.

I give below a table showing the results of these experiments on the minerals in the scale of hardness, giving the name of the mineral, the time that it was under abrasion, and the weight in grams of the quantity lost by abrasion. The specimens which were subjected to investigation were necessarily small, as I had no idea when I began of the power of the blast. They, however, show conclusively the principle upon which the curious abrasions of rocks over large areas found in the far West, which are the admiration of the geologist and the wonder of the tourist, are produced:

Mineral.	Time under the Blast.	Quantity lost Grams.
Topaz (Goute d'Eau)........................	1 minute	1.9707
" pebble........................	1 "	2.1499
Emery from Chester, Mass.	1 "	4.9532
Corundum from Delaware Co., Pa........	½ "	1.1698
Black Diamond........................	3 "	0.0372
Black Diamond........................	5 "	0.0497
Black Diamond........................	8 "	0.0869

The emery from Chester, Mass., is contained in a considerable quantity of menaccanite and magnetite. A hole was made through the centre of the specimen almost immediately, leaving the corundum projecting, but all of its surface was acted upon, though at a different rate from that of the magnetite. The iron minerals were so much softer than the corundum that they worked out before the corundum had an opportunity of being very much abraded. A conical hole was made in the topaz pebble, which in a few seconds longer would have penetrated it, and the pebble would have broken in two from the increase of the hole towards the sides. The corundum crystal had also a conical hole made in it, large enough to put the little finger through. The face of the black diamond exposed to the blast was originally rough, but became quite smooth at the end of the experiment. A microscopic examination of the surface of each of the specimens showed a surface ground exactly like the rolled surface of stones exposed to abrasion against harder substances in water. There was nothing peculiar about it, except that wherever there was a difference in the composition, there was a difference in the depth of the pitting which is so characteristic of abraded surfaces.

In order to ascertain what the direct application of these facts to the buildings might be, I commenced a series of examinations on the composition of the dust of cities. I found it made up of organic material of various kinds and sizes; of very minute, but very sharp particles of iron, mixed occasionally with other metals; and of considerable quantities of clear and very sharp quartz, with some feldspar, together with a few other minerals, such as are found in the paving-stones and dirt of cities, ground to an impalpable powder. After a heavy rain, preceded by high winds, I was soon able to collect considerable quantities of sharp quartz-sand, which could be easily studied with a microscope. On a March day we are often made aware how sharp such sand sometimes is. When such dust is carried by high winds of a velocity of from thirty to ninety miles an hour, it abrades the surface of all the soft and, after a time, of some of the harder stones, which cannot resist the power of this dust, hurled against it at such high velocities. If the surfaces of some abraded stones are examined with a microscope, grains of a material of a nature quite foreign to those of the stone will be found adhering to it. This effect is much more prominent in cities than in the open country, as it is there aided by the city gases, but it takes place in the country as well. I have not unfrequently seen buildings in the open country whose abraded surfaces were due to this cause alone.

These experiments prove the fact, beyond doubt, that even the hardest substance may be abraded by a comparatively soft material hurled against it at a high velocity. I had intended, at the close of these experiments, had I been able to get the use of the sand-blast machine, to gradually reduce the hardness of the sand and increase the velocity of the blast until I should have used flour, so as in this way to study the action of the soft material contained in the city dust upon the stone. I am satisfied, from many hundreds of observations made on monuments and on the surfaces of buildings, both in this country and abroad, that some at least of the decomposition that is attributed to other causes is due to the action of the winds. There are many places where the falling out of the mortar between the stones, and the rounding of the corners at that particular point, can hardly be attributable to any other cause. Usually such stones as these, unless they are very soft, have the abraded surface quite as hard as the rest of the stone, while those which are disintegrated from the loss of any part of the constituents of the stone, whether they are superficial or produced from internal causes, are always easily rubbed into sand. There are many instances of this character in the sandstones used in some of the old buildings of Europe, the binding material of the grains of which has been entirely siliceous, the stones being worn and rounded in this way so as to produce a very curious effect upon the weather-beaten surfaces. Independent of the effect of the sand hurled by high winds, it must be taken into account, also, that during violent rains, when the wind is high, the pressure of the wind will force into the stone several percentages more moisture than it would under other circumstances. If buildings so exposed to the action of rain blown against it by the wind have the usual architectural defects of flat surfaces and moldings not undercut, the disintegration of the stone composing them must be very rapid in cold climates. If, in addition to this action of the wind, any part of the binding material is dissolved out by the rain, the decay of the stone will be very rapid, and will be produced usually without any symptom of flaking, because the surface will be worn away before the decomposition has gone far enough into the interior to cause the flaking to take place. The decay, therefore, will generally remain unnoticed.

In the selection of stones for building purposes, too little attention is given to their microscopical characters, and sometimes, when they are so examined, too much stress is laid on phenomena of little importance. It will not do to say that because a rock contains a mineral that has already commenced to decompose, as shown by the examination unde

* A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

the microscope, therefore this stone is valueless. I have, in my collection of microscopic slides, several sandstones, the feldspar in which has commenced to kaolinize, but in which the decay has been arrested. This decomposition undoubtedly took place in these sandstones, which are of triassic origin, previous to the degradation of the rocks which now compose them. When these were ground up, and their elements redistributed to form the sandstone, there seems to have been a cessation of the causes which produced the decomposition, which was arrested, and has not since, so far as we can see, advanced any further in the rock.

The characters which it is important to observe are, whether there are contained in the stone, minerals which are either already decomposed, or are likely to become so; whether these minerals contain water in cavities in considerable quantities; or whether, either by disintegration or by the looseness of the binding material, the stone contains so many interstices or fissures that it is likely to absorb large amounts of water, which may either attack certain of the constituents, causing them to swell, or may itself, under the influence of a severe climate, have sufficient power, in the form of ice, to disintegrate the stone. The examination of the stone in the quarry should be conducted as a whole, and not with reference to a particular part of it, for it not unfrequently happens that stones composed of exactly the same minerals have entirely different properties, as granite and gneiss, for example, and yet one of them may not be a proper stone for outside construction. The age of the stone, since its extraction from the quarry, may or may not be in its favor. Nearly all stones are weaker immediately after their extraction, while they hold the quarry water, than after they have lost it. Most stones after long exposure, more especially if they have not been uniformly moist, absorb more water than when they are fresh, and are therefore more likely to disintegrate from frost than when they were younger, or than if they were kept uniformly moist. Certain rocks exposed to high heat or to severe cold lose their power of resistance along irregular lines of weakness, and tend to disintegrate, and this effect may be produced by artificial heating as well as by climate. Stones, therefore, which endure exceedingly well in one climate may not stand in another, as witness the attempt to use in this city certain limestones and sandstones which had stood exceedingly well abroad. The particular place where the structure is to be erected, whether in the city or country, is to be considered. In the city there are noxious and corroding gases, coming either from fuels or manufactories; the dryness or dampness of the ground is to be considered, and whether the particular spot chosen is well ventilated or not; in the country, whether the air is humid or dry, or whether there are prevailing high winds carrying sand. All these, and many other circumstances, have great influence on the durability of building-stones, and should be carefully considered before expensive structures are undertaken.

(To be continued.)

THE WISDOM OF MAKING ADEQUATE APPROPRIATIONS FOR PUBLIC WORKS.

We quote below from a special report recently made by General Gillmore, U. S. Engineers, on the improvement of the harbor of Charleston, S. C. He once more shows the wastefulness of the common practice of appropriating sums for public works too small to be of any value, with the result of increasing the cost over what it would have been, had sufficient appropriations allowed the work to be carried on at the best advantage. The bill in question was the measure introduced by Senator Butler, making an appropriation for the jetties:

"The bill commends itself to the judgment of every intelligent engineer. The enactment of such a bill, or something substantially equivalent thereto, appears to be absolutely necessary in order, not only to secure any fair progress in the construction of the Charleston Jetties, but to prevent the complete destruction of work already done. The last stoppage of work on this improvement was a very expensive one to the United States.

"A recent examination of the jetties discloses the fact that fully one-half of the appropriation made August 5, 1886, will need to be expended in repairing damages that would not have occurred had there been no suspension of operations. This estimate is a moderate one, and takes no account of the deterioration of the contractor's plant, which will, of course, have to be paid for in full under the present contract. It is, and should be, the first consideration, in a business point of view, for the contractor to reimburse himself wholly for the cost and outfit of plant from the profits of the contract in hand, as he cannot, under existing methods, be sure of ever getting another. This, moreover, is in accordance with the prevailing custom.

"Previous stoppages have not been quite so disastrous as this one. When the best has been said and done, however, the final result will doubtless be that the jetties will cost at least one-half more than the amount of the original estimate ($3,000,000) of the board of engineers to whom the plan was submitted before it went to Congress, unless a radical change is made in the rate at which funds are supplied from this time forward. A continuous yearly appropriation of inadequate sums would be of little or no use. The result well might be that the progess of building up would be less rapid than the progress made by the sea in tearing down the work.

"If we suppose, for instance, that a bill be enacted appropriating from $100,000 to $120,000 annually from twelve to fifteen years for completing these jetties, any competent engineer will claim that at the expiration of that time the works might not be any nearer completion than they are now. More than this, every vestige of work hereafter done might be swept away in the meantime. This is the tendency of all small appropriations, spread over several miles of unfinished work, located as the Charleston jetties are in a rough open sea. They merely maintain the work, and the yearly sum necessary to secure this negative advantage becomes greater and greater with the lapse of time. I believe the Charleston works are the only ones now in progress where a disaster of this kind need be apprehended. I most respectfully submit my earnest protest against this most extravagant and wasteful method of constructing important public works.

"Unless some exceptional provision is made there is likely to be another stoppage when the existing appropriation is exhausted. It is all pledged to one contractor, and he assures me he can expend it in three or four months. I can conscientiously urge the passage of the Senate bill 2,944. The appropriation should of course become available on the passage of the bill."

WATER-SUPPLY AND SEWERAGE IN MASSACHUSETTS.

An important report on this subject made by the State Board of Health of Massachusetts has just been made public. The report states:

"We are more convinced from day to day of the necessity of some control of the questions of water-supply and drainage, so removed from individual towns and cities, as to be able to consider dispassionately the interests of all parties who may be affected. With a city or town, the decision must necessarily be a selfish one. Not one of the towns draining into the Charles River has cared very much what might result from the deposits of foul matters farther down the river; and yet the same communities have been much disturbed at pollutions of the stream above them.

"By the analyses of Merrimac River water made in 1873, 1879, and 1886, we find that in 1873, when the amount of impurity in the water was sufficiently small to allow the water of the river, both at Lowell and at Lawrence, to be accepted as good drinking-water, the impurities then added by the sewage of Lowell and the refuse from the factories were so modified by flowing nine miles, and by being diluted by the increase in quantity of water, due to an increase of one-seventh of the drainage area, that the water at Lawrence above the city was as good as that above Lowell; but in 1886 we find that, with substantially the same quantity of water flowing in the river, the percentage of impurities from animal and vegetable putrefaction, as shown by the 'albuminoid ammonia,' has increased above Lowell by 36 per cent., and above Lawrence by 57 per cent.; and that the impurities poured into the river at Lowell are now greater than the exposure to the air in flowing nine miles and the increased dilution can overcome, leaving the water above Lawrence with 12 per cent. more of impurities, due to animal and vegetable putrefaction, than that above Lowell, and 57 per cent. more than it contained when the waterworks were established at Lawrence, and now approximating the undetermined border-line beyond which the water would be unfit for drinking.

"These results were obtained in September and October, when the quantity of water flowing in the river was about double the minimum quantity known to flow during a week of severe drought.

"In considering the table of analyses of the Merrimac River water still further, we find that, although polluted by the factories of Lowell and Lawrence, and such sewage as was then discharged, the analyses of 1873 showed the water above Bradford and Haverhill to be as good as that above Lowell; but this result no longer obtains, for the analyses of 1886 show the water above Bradford to have 34 per cent. more impurity than that above Lowell, and 81 per cent. more than it had in 1873, rendering it, unquestionably, an unfit source for the domestic water-supply of Bradford.

"This result is not unexpected; the same result has happened to every water course in the State which lies in the midst of a populous and growing district. A gradually increasing mass of pollution suddenly reaches a point at which the stream is no longer able to neutralize it, either by dilution or by any of the so-called processes of oxidation; and a condition of things may be arrived at as disgusting as that of the Blackstone at Millbury, or of Alewife Brook in Cambridge and Somerville, or of the North River at Salem.

"In no one of these instances was the introduction of sewage a nuisance originally, and in no one of them would it have been possible to say in advance just where the saturation point would be reached."

The report embodies a report from Mr. F. P. Stearns, Engineer of the Board, Mr. Joseph P. Davis being Consulting Engineer, and Mr. H. H. Goodnough, Assistant. As to the best method of taking samples from a stream for examination, this report, after giving tables respecting the pollution of the Merrimac River, states:

"The sewage of a city generally flows into a river from one side, and only after flowing a considerable distance does it become thoroughly mixed throughout the whole volume of water. Perfection in the method of taking samples for analysis would be reached if every part of the stream contributed to the sample a quantity proportionate to the volume passing that part. Practically this condition can be approximately fulfilled by dividing the width of the stream into two or three parts, each carrying approximately equal volumes, and filling a bottle from each of these divisions, taking water from different parts of them in proportion to the depth and velocity of the stream. It was found that very satisfactory samples could be taken from a boat by holding the neck of the bottle below the surface of the water, and allowing it to fill while the boat was being rowed across the stream; the speed of the boat being decreased where the water was deep to allow a larger quantity of water to enter the bottle from these places. Most of the analyses given were made from samples taken in this way. These show, as no previous ones have done, a marked increase in the impurity of the water going down stream."

The remainder of the report is taken up by a brief account of the suggestions respecting water-supply and drainage made to a number of towns, and a reprint of the law for the "Protection of the Purity of Inland Waters."

PUMPS AT THE MARE ISLAND NAVY YARD.

At the meeting of Philadelphia Engineers' Club on January 8, Mr. Henry R. Cornelius read a paper relating to the two large centrifugal pumps at Mare Island Navy Yard, California, built by the Southwark Foundry and Machine Company.

The pumps, the dimensions of which are 42-inch discharge pipes and 66-inch runners, are each driven direct by a vertical engine 28 inches diameter by 24-inch stroke, and were designed to remove the water from a dock 529 feet long, 122 feet wide, and 36 feet deep, with a capacity of 9,000,000 gallons. After being erected on foundations prepared by the Government, a test-trial was made by a Naval Board, the following being extracts from their report: "At the final trial of the two pumps together, the water was admitted to the 23d altar, the dock containing 7,317,779 gallons, being seven feet above the centre of the pumps. Everything moved *most* admirably. During a pumping period of 55 minutes the dock had been emptied from the 23d to 2 inches above the 6th altar, containing 6,210,698 gallons, an average throughout of 112,922 gallons per minute. At one time, when the revolutions were increased to 160 per minute, the discharge was 137,797 gallons per minute. The indicator cards taken at various intervals gave 796 horse-power, and the revolutions did not exceed 160 at any time, though it was estimated that 900 horse-power and 210 revolutions would be necessary to attain the requisite delivery, so that there is a large reserve of power available at any time."

ENGINEERING AT NEWTON, MASS.

The annual report for 1885 (just issued) of the engineering department of the city of Newton, Mass., by Albert F. Noyes, City Engineer, is at hand.

The appropriation for the department for the year, $6,750, exceeds the expenditures by one cent. Recommendations are made as to the defining of street lines by stone monuments, and for authority to have kept accounts of the details of cost of different classes of work. There were 92,875 square yards of Telford pavement laid during the year. Tabular statements are given of the amount of cost of concrete in sidewalks and curbing; of the amount and cost of drains and inlets, and of catch-basins, and tables of various repairs.

Examinations were made as to the best method of obtaining additional water-supply at an expense of $500. Soundings were made by boring to determine the stratification of the subsoil on both sides of the Charles River. As a result $15,000 was appropriated for driving tubed wells, to be joined together by a main, laid below the normal depth of the subsoil water, and carried to the pump-well, with its outlet below low-water mark. If enough additional water is not obtained in this way at all times, it is proposed to attach the pipe to the suction of the high-pressure pump to be used when necessary. The first contractor not having done the work satisfactorily, a new contract has been made with the Manhattan Artesian Well Co., of New York, who agree to supply the water at a given rate per thousand gallons furnished upon the thirty-first day of a continuous test.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

A NARROW ESCAPE FROM INJURY BY AN EXPLOSION OF GAS IN A BOILER.

We read in a late engineering journal a case where a boiler inspector of an insurance company was examining a boiler, which had been lying unused all summer in a cellar under a drug-store, when an explosion followed which came near costing the inspector his life. He was about to enter the boiler through the manhole, which had been left closed since the spring, and, as a quantity of some explosive gas had collected in the boiler unknown to the inspector, he raised the cover and put a lighted candle into the opening, when an explosion followed, throwing him from the top of the boiler to the floor, and filling the cellar with smoke. Had the inspector entered the boiler before the explosion, in his own words, "there wouldn't have been much left of him." As it was, he was terribly burned about the face and hands, and shaken up by his fall. The journal then goes on to say: "This should be a warning to all inspectors not to enter a boiler, especially if it has been out of use for some time, until they have satisfied themselves that there is no foul gas within. This can be ascertained by cautiously introducing a lighted candle."

[Undoubtedly the lighted candle is an emphatic way of testing for explosive gases, but we do not see that it is much better for the man who holds the candle whether he introduces it cautiously or unsuspectingly, should he happen to be at the other end of it when the explosion takes place. We would advise airing the boiler by taking off the hand and manholes plates and introducing the candle an hour or two afterwards at the end of a very long stick.

The vapor or gases of hydrocarbon oils are always dangerous within boilers, and it should be the duty of an inspector to inquire of the engineer whether he used crude petroleum or any of the products of crude oil, such as kerosene, as a boiler purge before he attempted to enter a boiler. The smell is not always sufficient to indicate the fact.—Ed.]

RESPONSIBILITY FOR FREEZING OF STEAM-COILS.

New York, January 18, 1887.

Sir: A disputed point often arises between steam-heating contractor and owner in unfinished houses where the apparatus is operated by owner for his own convenience before the apparatus is accepted. The coils used for indirect heating are often allowed to freeze. What is the best way to prevent freezing? G.

[When an owner insists on the use of an apparatus before its completion he should be responsible for any damage that may occur, and the contractor would do well to protest in all such cases and refuse to allow the apparatus to be used unless the owner accepted the responsibility. It is the habit with some contractors to furnish a man of their own selection to run the apparatus for the owner's benefit on the payment of a stipulated amount per day. In such cases the contractor is the responsible party. No complete and well-constructed apparatus will freeze unless it is neglected. When steam is in the pipes they *cannot* freeze, as the heat will prevent it; and when steam is down, the pipes and coils should be empty as low down as the water-line, and consequently cannot freeze, as there is nothing within them to freeze. If the return pipes are allowed to remain filled with water in a cold and open building they will, of course, freeze, and under such circumstances they should be drawn off.

A poor fire will cause freezing in a steam apparatus by allowing a vapor to go over into the pipes where it will condense and freeze, but when sufficient steam is sent over this cannot happen. Where valves are used on indirect coils, and either one of them becomes closed by accident or design, the coil will freeze if the air passing over it is sufficiently cold. When the upper or steam-valve is closed the supply of steam to the coil is interrupted and what remains within it condenses, forming a vacuum that draws the water from the return pipe into the coil and allows it to freeze. When the lower or return valve is closed the water of condensation accumulates within the coil and it freezes. Should either or both valves becomes sufficiently closed to lessen the pressure on the coil a pound or two, according to their height above the water-line, they (the coils) will freeze, or should the valves leak when closed from a defect, or by being carelessly closed, so as to allow the return water to rise slowly into the coil or a leakage of steam into the coil, they will freeze. A good way for private house-work is not to use valves in the coil for indirect heating. Then the chances of freezing are reduced to mismanagement at the boiler only. Some will say this will result in an unnecessary waste of fuel. It will result in some waste, but if the air-ducts and registers are closed tightly this waste will not be great. The vapor from a banked fire will go over into a steam apparatus, and should it blow suddenly cold during the night the apparatus will freeze. All causes of freezing, except those caused by leaky valves, are those o management, in a properly constructed apparatus. If an apparatus is so made that the water in the indirect coils will not fall below the bottom of the coil under proper manipulation, then freezing may follow in very cold weather.]

REMOVING AND EXCLUDING AIR FROM STEAM-RADIATORS.

Odessa, Del., January 13, 1887.

Sir: Begging pardon for addressing you, I will proceed to state my case, believing when you have heard it you will excuse me, as some of what I say may be of interest to your readers. I am a steamboat engineer, and during the winter months my time is largely at my own disposal, and I am free to read and study. The intense cold weather of last winter directed my attention to the fact that the means employed in heating the residences of this neighborhood were inadequate. Nearly everybody complained of the enormous quantity of fuel consumed and the utter impossibility of keeping comfortably warm. I commenced studying this problem, and my attention was directed to steam as the best means of its solution. Steam has as yet been introduced to a very limited extent in this vicinity. I have gathered together all the information within my reach, and have studied carefully all the defects of the present systems as I see them.

The result of my study has been the working out in my own mind of some plans by which the popular prejudice in regard to heating by steam for suburban residences can in a measure be overcome. It is this which I wish to bring to your notice and for which I am trespassing on your time. The prominent difficulty in the details of any and all low-pressure heating systems seems to be, the presence of air in the radiator's connections, etc., and the difficulty experienced in expelling it. I would propose a plan by which this difficulty would be permanently overcome, and which would be to exhaust the air from the radiator's connections, etc. This may seem impracticable. But for a moment look upon it as practicable, and assume that the air is exhausted from pipes and radiators, and that above the water-line in the boiler there exists a vacuum. The boiling point of water is but little above 100° under such conditions, and at the pressure of the atmosphere about 212°. Now when the boiling point is reached of course steam will be generated, and when the temperature of 212° is reached there will be an absolute internal pressure counterbalancing the pressure of the atmosphere. We will now have a system upon which there is positively and absolutely no pressure whatever, and to this can be added that there will be no waste whatever, because there will be no place where waste can occur. As to the practicability of producing and maintaining a vacuum, I would propose to use a boiler with a very high factor of safety—one that would be able to withstand a safe working pressure of from 80 to 100 pounds to the square inch. With this high pressure upon the boiler, and shut off from radiators, etc., I would use a simple steam-jet or ejector with which to exhaust the air, then shut off everything communicating with the atmosphere and make all absolutely air-tight. After which introduce the proper quantity of water into the boiler, close it up tight, and allow the pressure to go down. I would propose to use but a single radiator connection, with no valves, but stop-valve at boiler. The construction of the radiator can be considerably modified and cheapened, not necessitating any return-bends, air-valves, etc. With each system put in and close down to the boiler I would place the ejector, which at the commencement of the season would have to be used by some skilled attendant to exhaust the air. It appears to me that the success of such a system would depend chiefly upon the ability to simply and cheaply exhaust the air.

My acquaintance with the use of steam for power purposes, as far as practice is concerned, has been somewhat extended, but in its use as a heating agent I have had comparatively little experience. I evolved these plans through my own mind, and I felt as though I would like to place them before some competent authority on the subject and learn whether or not they would consider that I am in error, and if their application involves some fatal fallacy which I may have overlooked.

I would be highly pleased to learn what you may think of these plans, and have your candid expression of opinion concerning their merits.

Yours truly, W. G. T.

[Our correspondent shows he has given a subject new to him a great deal of consideration.

The matter, however, of expelling and totally excluding the air afterwards from a steam-heating apparatus is not new. The Sanitary Engineer and Construction Record, through its correspondent, the late Robert Briggs, alluded to this about four years ago and explained how steam below atmospheric pressures and temperatures could be used in a closed system. So far, however, we are not aware of its being made practicable, though every time the steam falls below atmosphere on a closed circuit pressures at atmosphere and below it must take place for a short time, or while the pressure is decreasing and before the atmosphere gets in. To make it practicable, however, an *absolutely* air-tight apparatus must be perfected, and a means of regulating the draught-door by pressures below atmosphere must be invented. We do not consider these things impossible, but the making absolutely tight of ordinary boilers, radiators, pipes, and fittings we consider improbable. We are not sure that our correspondent contemplated using steam below atmosphere, but the matter of maintaining the vacuum will be the same whether he did or not, as there will be long periods during any winter when the steam will have gone down in the boiler.

We cannot see the necessity of an injector to produce the vacuum—admitting the scheme to be practicable. If the air is blown from the pipes with eighty pounds of steam by displacement (instead of using that pressure in an injector, and then allowing it to condense), there will be a more complete vacuum in the pipes than there could be obtained by an injector, and this vacuum would apply to the boiler above the water-level.

We think, also, our correspondent greatly overrates the trouble attending the expulsion of the air from modern steam apparatus. With properly constructed pipes and coils the air will move ahead of the steam and escape by the automatic vents as readily as steam is formed.

There are, however, many apparatus poorly constructed by persons who have had little or no experience that gives much trouble from "air-binding." Such apparatus, however, it would be better to remodel than to attempt to make absolutely tight.

A steam-radiator either that cannot be closed or shut off from the system is not to be desired for many reasons too obvious to mention.

If our correspondent intends to use a radiator without return bends, or a welded pipe without a septum, we are pretty sure he will encounter trouble, for when he finds it impracticable to produce and maintain the necessary vacuum, it will be advantageous to have radiators that wil work under ordinary conditions.]

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. III.

(Continued from page 139.)

THE TRAPPING AND VENTILATION OF SOIL-PIPES (CONTINUED).

Note.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of The Sanitary Engineer and Construction Record on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

19. Why is a flap-valve not a good seal for a drain or waste-pipe?

Matter lodging under flap will prevent its closing properly.

20. Why is the momentum of a column of water not likely to carry the water through a running trap and leave the trap unsealed?

Because the velocity is not generally sufficient to produce a vacuum.

21. What is the effect of a column of water passing through a pipe and completely filling it?

It drives the air before it, and by so doing it creates a vacuum and draws water out of trap.

22. Why will a vacuum suck the air out of traps?

The effort of air to fill vacuum will drive the water in the trap before it.

23. What is the pressure of the atmosphere on a vacuum?

Fifteen pounds per square inch.

24. How is this suction prevented?

By leaving top of soil-pipe open so that air will follow water and prevent a vacuum.

25. Can a vacuum be created in a pipe when it is only partly filled with water?

An entire vacuum cannot be so created, but there is danger of a partial vacuum.

26. What is the object of extending a pipe from the outer air to the drain-pipe just inside the trap?

To allow a current of air to pass through the pipe.

27. What difference does it make where this pipe enters a drain-pipe so long as it is inside the point where the trap is placed?

It should enter near the trap or the portion of drain-pipe between it, and the trap will form a dead end.

28. What is the proper size of this ventilating-pipe?

Four inches.

29. Why does the air enter by this pipe and pass out at the top of the soil-pipe?

The air in the pipe being usually warmer than the outside air, and, therefore, lighter, is bound to ascend, as in a chimney.

30. Why does warm air ascend?

Because it is lighter than cold air.

31. Can a rush of water through the drain-pipe affect this ventilating-pipe, and should any precaution be taken in regard to it?

It should be placed as far as possible from basement or cellar windows where cold-air box may be situated.

32. Is it a good plan to ventilate a soil-pipe in a flue, and why not?

No; because when there is no fire there is often a down draught, which brings sewer-gas into rooms.

33. Would two traps where the drain-pipe enters the house be useful?

No; they would form "an air-lock."

34. What is an air-lock?

Space in pipe where air is confined between two traps.

35. How does it affect the passage of water?

The confined air is like a cushion or sponge, and retards or stops the flow of water.

36. What is the objection to the use of a brick or stone box with a division wall, known as a mason's trap, as a trap for a main soil-pipe?

It makes a small cesspool, and cannot be made self-cleansing.

37. If a drain-pipe empties into a stream, or on the surface of the ground, and has no connection with a sewer or cesspool, is a trap useful?

Yes, because sewer-gas is generated; and if the pipe is long it is better to trap and ventilate where it enters the house.

38. If a pipe enters into tide-water what precaution should be taken to guard against air being forced through the trap by the pressure of the tides?

To place a vent-pipe between outlet and the trap.

39. What is meant by the "dead end" of a soil-pipe?

An unventilated end.

40. Why are such ends dangerous?

Because sewer-gas collects in them.

41. How would you connect the leaders of a house with the drain-pipe?

By a deep-seal trap so as to prolong the evaporation of the water.

42. How would you connect area and yard drains with drain-pipes?

By suitable traps with house-drain, and always on the inside or house side of traps.

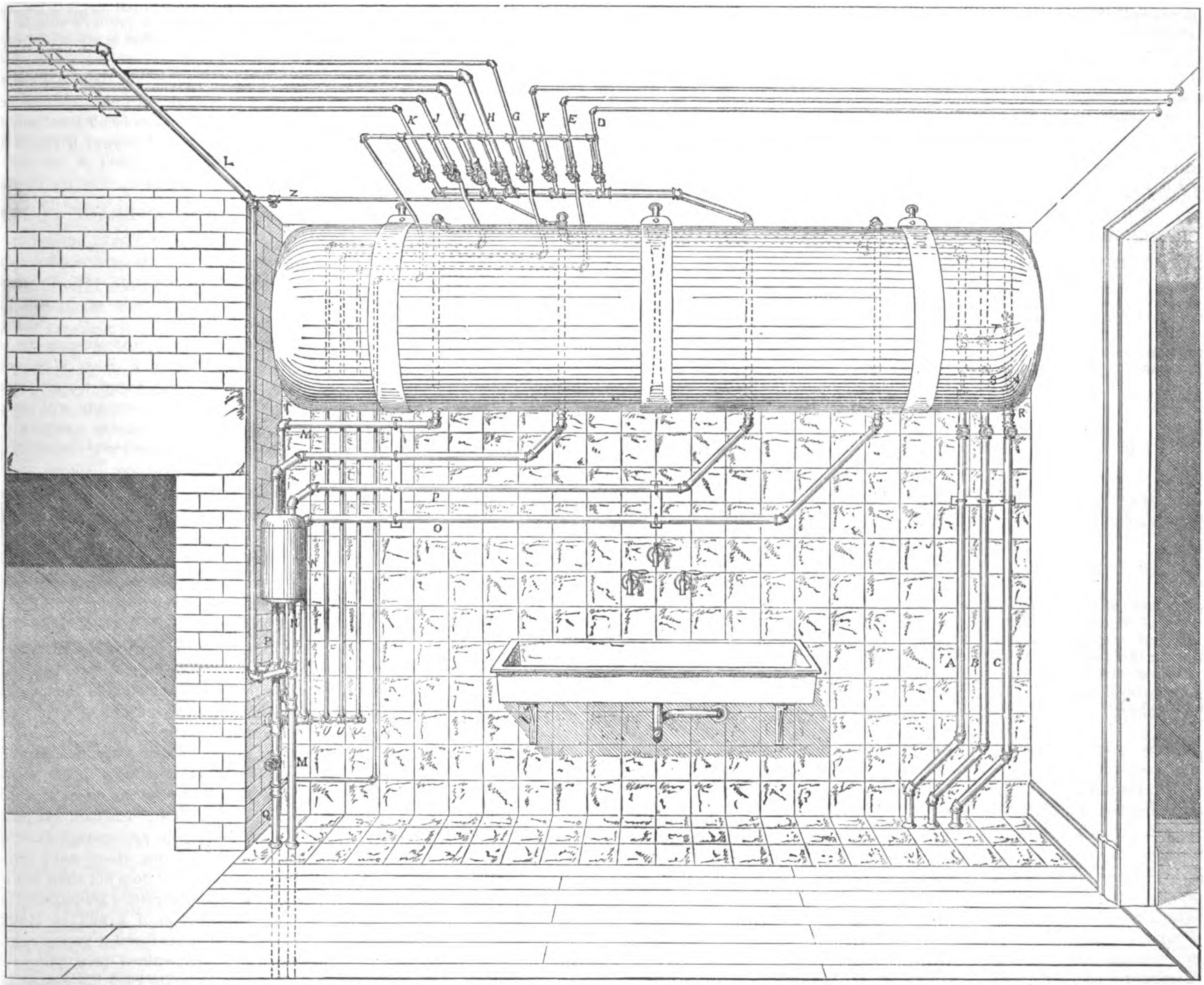
43. When traps are emptied of water to guard against freezing, in an unoccupied house or apartment, what precautions can be taken to shut out sewer-gas?

The traps should be filled with glycerine.

44. Is there any contrivance by which a soil-pipe can be regularly flushed?

Yes; by an automatic flush-tank.

(To be continued.)



BOILERS IN A FIFTH AVENUE RESIDENCE.

The accompanying illustration represents the boilers in the kitchen of No. 417 Fifth Avenue, in this city. The boilers are of heavy copper and suspended from the ceiling by three broad brass straps and iron bars. These latter are bolted securely to a wrought-iron strap, 3x⅝-inch, extending from the chimney-breast to the opposite wall, thus distributing the weight of the boilers over all the beams of the floor above. The pipes about the boilers are all of galvanized iron, covered with silver bronze; the supports are of brass, nickel-plated, and the valves are of brass. The wall and part of the floor back of the boilers is set with cream-colored glazed tiles, which makes a very bright background for the pipes, and is suggestive of neatness and cleanliness. The sink is of iron, and, in addition to the trap shown in the illustration, is provided with a grease-trap, located in the cellar directly beneath. The boilers are really two separate cylinders, with only one outside shell. On the inside this shell is divided at the centre of the length by two heads placed about an inch apart, as shown by the dotted lines.

By reference to the "Explanation of Diagram" the arrangement of the pipes can be readily understood. The connection at S, between the street-supply and tank-supply pipes to the boilers, is to allow the tank-boiler to be supplied by street-pressure should the tank-supply fail from any cause. The check-valve V prevents the filling of the street-boiler from the tank when the pressure exceeds that from the street-main. The connection at T allows the street-boiler to be filled from the tank when required, the check-valve R preventing the return of water from this source to the street-main when the pressure of the former is greater than the latter. The street-boiler (left hand) is connected with one compartment of the heater W, and the tank boiler (right hand) is connected with the other compartment of the heater. Each compartment of the heater is also connected with one of the two ranges in the kitchen and laundry, the result being that the water in both boilers is heated if either range is fired, in the one boiler directly, in the other by the heat transmitted through the compartment of the heater W. In the kitchen range a water-back of the largest size used. This back is made with two connections cast on, for convenience in setting and connecting. In this job, to obviate danger of noise, from the great size of the back and small diameter of the connections (1-inch), both connections were used, being branched, by a pipe carried around the range outside, into a 1¼-inch pipe to the heater. No noise has occurred.

The valve at M allows the complete draining of the boilers, pipes, and kitchen water-back, the laundry water-back being drained by a separate valve on the pipe M in the cellar. Circulation of hot water through the main supply-pipes is maintained by the pipes U U U, each of which is provided with a swinging check-valve to prevent reverse circulation. The pipe X drains the entire system of pipes above the boiler. The pipe and valve Z is to relieve any air that may collect in the return from the laundry water-back L.

The master plumber was Mr. Thomas J. Byrnes, of this city. The inventor of the boiler and auxiliary heater was Mr. John Tucker, also of this city.

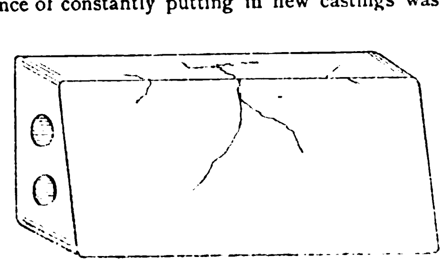
EXPLANATION OF DIAGRAM.

a. Cold supply from tank.
b. Hot kitchen-sink, laundry-tubs, and front basement fixtures.
c. Street, cold.
d. Hot butler's pantry.
e. Circulation of *d* and *f*.
f. Hot to second and third floor basins (extension).
g. Circulation of *h*.
h. Main supply to central bath-rooms, second and third floors.
i. Main supply to tiled bath-rooms, second, third, and fourth floors, and slop-sink, second and third floors.
j. Circulation of *i*.
k. Relief.
l. Return from laundry water-back to street-boiler drained below.
m. Supply from street-boiler to laundry water-back.
n. Return from laundry water-back to street-boiler.
o. Supply from tank-boiler to kitchen water-back.
p. Return from water-back to boiler.
q. Sediment-pipe, tank-boiler.
A branch-pipe is taken from *m* in the cellar as a sediment for street-boiler.

CRACKING OF WATER-BACKS.

DETROIT, MICH., January 31, 1887.

SIR: A short time since I was called upon to examine the water-back in two large cooking-ranges which have caused constant trouble, not because they did not furnish hot water enough, but by cracks forming in the top and sides, which caused leakage enough to put the fires out. The nuisance of constantly putting in new castings was such



that backs were made of wrought-iron pipe and fittings were substituted in their stead. The sketch inclosed shows the form of back and position of hubs for circulating-pipes. These ranges are in a public institution and were from the factory of a first-class Western firm. Can you tell us why these water-backs give trouble in this manner when there is and always has been a plentiful supply of water to them? Yours truly, W. A. P.

[We should say by an examination of the drawing you send that the cause of the burning and consequent cracking of the water-backs is this: The cold water enters the back by the lower connection and expels the air before it until it reaches the upper connection or hot-water pipe, which, as

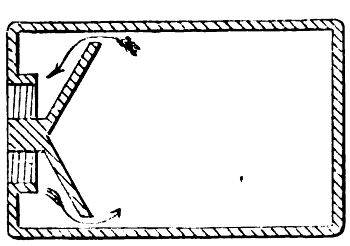


Fig. 1.

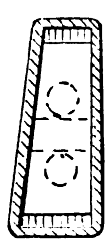


Fig 2

shown in the drawing, is some distance down from the top of "back." When the water reaches this outlet the remaining portion of the air above it is sealed up so that it cannot escape and is merely compressed until it balances the pressure in the water-main, and effectually prevents the water from raising nominally any higher than this point, and you will readily perceive that with a good fire on it would not be long before all this part of the water-back would become red hot, or nearly so, and undoubtedly soon burn out. The cracking can be accounted for by the undue expansion of this overheated part. If it is not possible to have a water-back made for these ranges with the hot-water connection close up to the top in consequence of obstructions caused by some peculiarity in the design of the top or side plates, the proper remedy would be to cast the back as shown in the sections, Figs. 1 and 2, which can be done by the makers of the ranges without adding anything to the cost of the molding. This would cause the back to fill and give a good circulation.]

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

STEAM REQUIRED FOR HEATING A RAILWAY TRAIN.

WILLIMANSETT, MASS., February 5, 1887.

SIR: In your journal of 29th of January is an article relative to the heating of cars by steam, in which an estimate of the maximum quantity of steam for the purpose that possibly could be required is the first *definite estimate* that has met my notice. The estimate, however, is far too high. For five years my attention has been devoted to the subject of car-heating, and experiments have been made at different times in order to determine the best quantity of heating surface per car. All of the cars piped on the Connecticut River road are seventy-seat cars, fifty-five feet sills, eighteen windows each side. One-inch, 1¼, 1½, and 2-inch pipe has been tried, and I prefer 1¼-inch, so arranged as to get 125 square feet of heating surface per car, which is found to be abundant; the only complaint with passengers being that the cars are kept too hot. There are twenty or more trains on this road now each way per day warmed with steam, beginning with one and showing a steady increase, and as trains are added they are piped and heated by steam from the engine, though in case of accident to the engine there is a small auxiliary boiler under each car; or, rather, that is my system. This little boiler has a 12-inch fire-box, in which a fire about six inches deep can be kept, and that makes the car so warm that it has been found necessary to put pipes on top of the car in which the steam could be condensed and returned to the boiler to keep up the water-supply in boiler. In the first trial the boiler, holding thirty-five gallons of water, was run for ten days without renewal. About four ordinary coal-hods full of coal were used in running from Springfield to St. Albans, a distance of 250 miles, and return, or 500 miles the trip. There is less trouble in heating the cars by steam from the engine or from the auxiliary boiler than by stoves. It takes just about the same steam to heat as to operate the brakes, certainly less than a horse-power per car, and actually less than where stoves are used, for it saves eight seats in a car, so that seven cars heated by steam from the locomotive are equal in seating capacity to eight heated by stoves. They are far safer, more comfortable, and, of course, far better ventilated, for the ventilators at the top are never closed. I don't believe that seventeen cars of ordinary length are ever taken in one train, unless in some special case, for that number could be run better divided in two, one a half or a whole hour later than the other, and would accommodate the traveling public better; and, still further, no engine of 17x24-inch cylinder could draw seventeen cars and make express time, unless they have engines on the N. Y. Central unknown upon the Eastern roads. Yours, etc.,

JAMES EMERSON.

[The estimate of the steam required for warming a train, to which our correspondent alludes above, was made with the view of being greater than actual practice could demonstrate, as it was our object to show how small a percentage of the steam made by a locomotive was required for the purpose of warming the train. We also agree with our correspondent that no, or, at least, very few, passenger trains ever have seventeen coaches, for such a train would of necessity be about a quarter of a mile long, but here we again took the extreme condition mentioned by the President of the N. Y. Central Railway, so that our estimate would not be open to the criticism of not being ample or of being unfair to the railroad companies.]

BURLINGTON, VT., February 5, 1887.

SIR: Seeing your article on the warming of railroad cars so as to prevent conflagration, and also the interview of the *Times* with President Depew, I would like to say that cars to be safe cannot be so with a coal-stove, and steam in cold climates is more expense and bother than it is worth.

Now I would be much obliged to you if you would kindly state in your journal (of which I am a constant reader) if a device for warming cars without danger of fire in a collision would attract the attention of railroad managers. I would also say that I have a practical plan for warming of cars without coal-stoves, steam or hot water. It is inexpensive and simple, and if you think it would be worth while to lay the plans before Mr. Depew or other railroad officials, you will much oblige by advising as the best way in which to go about the way to present the invention, also to guard against the device being stolen.

"X."

[We cannot agree with our correspondent that steam is more bother than it is worth, nor does General Manager Hain, of the New York Elevated Railroads, if we are to judge by the persistency with which he clings to steam and the method he advised for the Brooklyn Elevated Roads, which, by the way, did not take his advice, and are nearly always cold. Our correspondent may, however, have a better method than steam, and our advice is to file a caveat or apply for a patent, and at once present his method to the public and to railroad managers by drawings and explanations. Unless the scheme is wholly impracticable or is preposterous THE SANITARY ENGINEER AND CONSTRUCTION RECORD will illustrate it in its "Novelty" column.]

"SOCIAL STATISTICS OF CITIES."

COLUMBUS, O., January 27, 1887.

SIR: Some two or three weeks ago my attention was called to an article in THE SANITARY ENGINEER AND CONSTRUCTION RECORD. Said article spoke of the Tenth Census, Vol. 18, as giving the cost of production of gas in some four hundred New England cities. I have applied for the book at city library; they tell me it is not yet published; also at the State library. Have written our Member of Congress at Washington, but am unable to get the desired information. Can you tell me, is it Vol. 18, Tenth Census, I want, or was that a printer's mistake? I wish to make use of such information in my official capacity as an alderman. R.

[The Report is Vol. 18, of the Census Reports, being part of the "Social Statistics of Cities." It has been published several months, and can be obtained only from the Secretary of the Interior. A copy of it should be in the State Library at Columbus.]

THE NORFOLK SEWERAGE SYSTEM.

NEW YORK, January 27, 1887.

SIR: We have noticed in the correspondence column of your journal, issue of December 11, 1886, two communications relating to the Norfolk sewerage system, signed by George E. Waring, Jr.

Mr. Waring in every way misrepresents the claims of Patent No. 127,533, issued to W. Scott West, and owned by this company. He must accept the consequences of continuing to do so. This company will protect itself against all infringement, and against usurpers who seek notoriety by gross misrepresentation of the utility and value of the system of deep sewerage, known as the West system.

At the proper time, the city of Norfolk, and all parties deemed to be infringers on said patent, will have an opportunity to test its validity. Respectfully yours,

JOHN D. OTTIWELL, President.

STEADYING CHIMNEYS BY LOADING.

HERR A. HOLLENBERG contributes to the *Zeitschrift* of the German Society of Engineers an article upon the preventing or diminution of oscillation in chimney-stacks and high walls by loading with an excess of dead weight. He cites an instance of a chimney only 56 feet high, built in common lime mortar, which when completed was observed to oscillate to an alarming degree. Consequently the chimney was loaded by putting on the top an iron plate weighing upwards of 2½ cwt. The cure was perfect. Although the stack is built in an exposed situation, it has stood for sixteen years, during which many severe storms have tried its strength, yet it does not show any horizontal or vertical cracks. Similar results are recorded in connection with the construction of a mill at Müllfort, near Rheydt. Here a millowner found it necessary to heighten a building by two stories, without interrupting work in the factory below. The constant vibration caused by the machinery, however, destroyed the walls as soon as the bricks were laid. To check this effect the walls were heavily loaded with iron rails as fast as the cement would bear them; and by this means the additional height was safely reached—the vibration of the walls being completely stopped. Heavy stone and iron curbs for chimneys are not so generally placed upon chimney tops as formerly. It is commonly thought that these finishing touches were intended for ornament only; but according to the foregoing statement, there may have been more reason for them than has been generally supposed.—*Journal of Gas-Lighting.*

IT is reported that the plumbers of St. Paul propose to ignore the Board of Public Works in the matter of the order of the board demanding a filing with that body of sworn statements of all work done in the year just passed, before licenses are issued. The board claims the right to demand this, and the plumbers deny it. The result is quite likely to be determined in a lawsuit.

NEW ENGLAND WATER-WORKS ASSOCIATION.

THE February meeting of this association was held on the 9th inst., at Young's Hotel in Boston, at which there were present about fifty-six of the active and associate members.

Among the guests were Hiram F. Mills, C. E., of the Massachusetts State Board of Health, and C. E. Chandler, C. E., of Norwich, Conn.

Dinner was served at 1:30 P. M., and at its close President Rogers presented as the first speaker Hiram F. Mills, C. E., of Lawrence, Mass., who spoke briefly of the newly organized State Board of Health, and of what it proposed to do in matters which have especial interest for the association.

All inland waters in Massachusetts are now under the care of this board, and no plans for water-supply or for sewage disposal can be carried out without first being submitted to the board for approval. The board has asked for an appropriation of $30,000, and proposes to expend one-third of this amount in having chemical and microscopical examinations of some 2,000 different samples of water collected from all over the State. For one year samples a e to be collected monthly, and after that time semi-annually. The first examinations will have especial importance, as furnishing a standard for future comparisons.

Mr. Mills called attention to the increase in the impurity of the Merrimac at Lowell and Lawrence since 1873—viz., thirty-six per cent. at the former and fifty-seven per cent. at the latter—and concluded by asking the members of the association to co-operate with the State board in protecting and improving the quality of the inland waters of the State.

Mr. Mills' remarks were followed by questions and discussion from Messrs. Tidd, Fitzgerald, Holden, Rotch, Darling, and President Rogers.

Professor George F. Swain, of the Massachusetts Institute of Technology, read an able paper upon the "Influence of Forests upon Rainfall," which will be published in the journal of the association.

The paper was briefly discussed by Desmond Fitzgerald, C.E., in a serious vein, and by Commissioner W. M. Hawes, of Fall River, in his happy and humorous manner.

Mr. Fitzgerald supplemented the account of various experiments which is contained in Professor Swain's paper by a brief description of his arrangement of tanks sunk in the ground and filled with earth, and so connected by pipes and weighing tanks as to enable him to measure the relative amounts of percolation and evaporation under a given set of conditions.

The veteran engineer, Phineas Ball, of Worcester, spoke briefly upon the subject of Professor Swain's paper, and referred to the fact that he had found more water in a cubic foot of earth taken from an open lot than in another foot taken from within a forest.

A paper by Albert F. Noyes, C. E., of Newton, upon Driven Wells, was postponed until the next meeting, which will occur on the second Wednesday in March.

IOWA CIVIL ENGINEERS.

THE DUTIES OF THE CITY ENGINEER.

THE Iowa Society of Civil Engineers met at Des Moines February 3. The following officers were elected for 1887: President, William Stigh, of Burlington; Vice-President, M. Tschirgi, Jr., of Dubuque; Secretary, F. A. Macdonald, of Cedar Rapids; Treasurer, A. W. Swaultz, of Cedar Rapids. Executive Committee: Conrad Eimbeck, of Keokuk; W. W. Young, of Manchester. The president appointed as Committee on Membership M. Tschirgi, Jr., W. W. Young, Conrad Eimbeck; also, a Committee on Printing, J. M. Brown, F. A. Macdonald, G. Davis. City Engineer Tschirgi read a paper upon municipal engineering. "Our largest cities," he said, "generally elect a board of public works, apart from the city council, by which all improvements are projected, and with approval of the city council completed. The board consists generally of three prominent citizens, with the City Engineer a member *ex-officio*. Smaller cities generally have no such board, all improvements being ordered by the council of aldermen. The great defect in the latter system is the difficulty of carrying out any extensive public improvement most needed, for the reason that the funds available are frittered away in the various wards of the city on numerous minor improvements clamored for by interested parties, constituents of the several aldermen. The short term of the aldermen, with the slight salary generally allowed, combined with political favoritism, necessarily unfit such to judge of the comparative necessity of proposed improvements. A board of public works, with proper salaries, will be economical to even our smaller cities, wherever considerable annual improvements are made. In either case, of board of public works or general council, the one on whom rests the responsibility of properly planning and performing all public works is the City Engineer. This officer is in most cities at the head of all city improvements. In some cases the management is divided into departments, each with a chief and a corps of assistants. The appointment of the City Engineer is either made by the board of public works or the city council and in other cases elected by the citizens. Probably the first method is the best, as being less influenced by political changes. In one of our large cities the engineer is president *ex-officio* of the board of public works, and holds his position during good behavior and competency and cannot be removed for other causes. Civil service rules govern the emlyoyment of engineers in subordinate positions in New York City. The greatest obstacle to the proper conduct of public works arises from the fact the engineer is frequently selected on account of political preference rather than competency. The short term to which he is elected—generally one or two years— does not allow even a competent engineer sufficient time to become thoroughly acquainted with his duties and the distinctive requirements of the locality before he is liable to be succeeded by another. The duties of the City Engineer are ordinarily defined by ordinance, but he only who has occupied the position of City Engineer in a progressive city can realize the amount of work and trying duties he is required to perform. Where not divided into departments, he is required to make surveys, establish grades, run levels, plan and construct streets, sewers, bridges, buildings, and water-works, supervise laying of sidewalks, make special assessments, issue notices, permits, numbers of houses, etc. The first work requiring the skill of the engineer is to properly lay out town sites, especially with reference to future requirements of a large city where any such possibility exists. Few, if any, of our large cities were so planned. However, the same rules to a lim'ted extent are applicable to all towns or cities. First, all streets should be laid out systematically with a view to convenience and comfort, also with reference to economy of construction, future sanitary improvements, grades and drainage. Generally straight lines, with frequent and regular intersecting streets, is the best method of laying out streets, especially for business portions of a city. When there is some centrally located building of business, such as court house, city hall, market hall, or other prominent public building, it is very desirable to have several diagonal streets leading thereto. In resident portions of cities, especially if on hilly ground, curved may replace straight lines to advantage, by affording better grades at less cost of grading and improving property by avoiding heavy embankments or cuttings. Too often have streets been located by the property owner without a thought as to the requirements of grade or drainage, looking only to making a subdivision which would show well on paper. Cities have taken the matter in hand, to prevent future difficulties, by requiring plats to be first approved by city council before any streets become legal highways. Following the location of streets there is the important duty of establishing a comprehensive system of grades. If this work could always be done in advance of improvements, there would be but little difficulty of obtaining the best grades for a city. Unfortunately this is seldom the case, and it is a constant struggle with abutting property owners to endeavor to approximate to the best grade, after improvements have been made. The proper improvement of streets is a subject of considerable discussion and experiment. Capt. F. V. Greene's conclusion, in a recent paper, was that asphalt pavements will be the universal one. While this may, in a measure, be true, as regards large cities, and on certain streets in smaller cities, I think localities favored with cheaper material will always use them in preference to asphalt. The ample supply of pure and wholesome water to a community is a necessity. The health and protection of property in a city is in a great measure dependent upon a public supply of water. Plans of sewerage should embrace all the elements of proper disposal, adaptation to future growth of city, and economy of construction. The polution of streams or bodies of water which furnish the source of our water-supply is the great evil from which large cities are suffering and trying to overcome or remedy. The chemical and mechanical methods advocated to accomplish the object of rendering harmless the wastes of cities are numerous and in many instances in successful operation. Sanitary engineering has become a separate branch of engineering but the City Engineer must be informed of all improvements in sanitary appliances, especially those connected with sewers, ventilation, and house-connections. The general public is slow to recognize the necessity of sanitary improvements and the City Engineer is often largely instrumental in enlightening it by facts and figures at his command, and in common with his other engineers takes pride in a profession that increases the comforts, safety, and health of his fellow-men."

The association then adjourned to April 13, 1887.

MICHIGAN CIVIL ENGINEERS.

OFFICERS were elected at the annual meeting in Grand Rapids, which we noticed last week, as follows: President, George E. Steele, of Traverse City; Vice-President, F. Guild, of East Saginaw; Secretary, H. Hodgman, of Climax.

ARCHITECTURAL COMPETITIONS.

THE St. Louis *Post* contains the following abstract of a recent decision which will interest architects:

"The Missouri Supreme Court this morning affirmed the decision of the Court of Appeals in the case of Thomas Walsh against the St. Louis Exposition and Music Hall Association, a final decision in favor of Walsh. The case involves about $2,000 with costs and court charges. Walsh in company with other city architects and five non-resident architects, was invited to enter a competition submitting plans for the Exposition Building. The invitation was contained in a circular letter personally addressed to the architects, and various conditions were prescribed for the limitation of the competition. Five of the most meritorious plans submitted were to be awarded $500 each, and were then to become the property of the St. L. E. & M. H. Co. One of the five was to be selected as the most meritorious of all, and its author was to be made superintendent of the proposed building and paid the commission prescribed by the American Institute and the St. Louis Institute of Architects. Walsh alleged that his plan was selected as the most meritorious, but that the St. L. E. & M. H. Co. had subsequently declined to make him superintendent, which appointment would have paid him $20,000 in commissions. The St. Louis Circuit Court decided against him. The Court of Appeals reversed that decision on the ground the circular was a contract that bound the Exposition Company, and it could not plead that Walsh was personally unfit to superintend the work. The St. L. E. & M. H. Company appealed to the Supreme Court, where the Court of Appeals has been sustained."

PERSONAL.

WILLIAM WILLARD WILSON, Engineer and Superintendent of the Yonkers, N. Y., Water-Works, and City Surveyor, died on February 7, in the 47th year of his age. He was born in New York City, but his parents moving to Havana he was there educated as a civil engineer. Mr. Wilson was appointed City Engineer of Yonkers in 1874, and prepared plans of the water-works, on which, after some opposition, the works were finally built.

JOHN BEST, contractor, for some years superintending the construction of buildings in the U. S. Treasury Department, died in Utica, N. Y., January 31.

SIR JOSEPH WHITWORTH, the famous engineer, and maker of the Whitworth cannon, died at Monte Carlo, January 22.

OTTO BLOCK, of Rochester, N. Y., formerly Putnam & Block, architects, opens offices for himself in the American Express Building in that city.

H. C. KOCH & CO., architects, of Milwaukee, have removed from 105 Wisconsin Street to the new Insurance Building.

PRESIDENT WATROUS, of the New York, New Haven, and Hartford Railroad, says that, so far as his road is concerned, "if any system could be demonstrated to the officers having the subject in charge as sufficient to the task of creating the warmth needed and at the same time safe from all probable danger of setting cars on fire in case of an accident, we should joyfully welcome it, and should be glad to go to any reasonable expense in applying it to all our cars."

THE remarkable feature in the last report of the Medical Officer of Health, of the Coventry, England, Urban Sanitary District is that in a city of 47,000 inhabitants and containing 10,483 houses, the birth-rate should have been 33.1, while the death rate was only 16.3 per 1,000. Nor is this low death rate a temporary and exceptional matter; on the contrary it might almost have been predicted. The average death-rate in Coventry for the five years 1871-75 was 23, for the next five years it was 20.2, and for the five years just expired it has been 17.8, thus showing a progressive diminution, a large part of which is due to the lessening number of deaths from zymotic diseases.

The only epidemic during the year was one of scarlet fever, which appears to have been of very mild type, as the mortality among the hospital cases was only 2 per cent.

Dr. Mark Fenton, the Health Officer, calls attention to the large amount of useful sanitary work which has been done during the year, in the way of cleaning unwholesome houses, the removal of nuisances, etc., and it is evident that there has been much activity in this direction. He advises the construction of an abattoir, states that insufficient use is made of the "Sale of Food and Drugs Act," and warns the Mayor and members of the corporation that, to maintain the low death-rate and to continue progress, much more work is needed, and that additional powers to do such work must be obtained from Parliament.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
February 5.......	25.48	20.03	20.88	30.53	28.24	20.52	32.56

E. G. LOVE, Ph.D., *Gas Examiner.*

PITTSBURG has asked for an injunction to restrain the People's Natural-Gas Company from tearing up the streets to lay pipes.

ELECTRIC-LIGHTING OF MILAN CATHEDRAL.—It is stated that the Pope has at length overcome his long-entertained scruples about admitting so heretical a power as electricity into the sacred precincts of Milan Cathedral, and has consented to its being lighted electrically.—*Electrician.*

A GAS-ENGINE has been invented by Maerz, of Berlin, in which one explosion takes place during each revolution. During the time of exhausting, a stream of fresh air is forced through the cylinder, by means of a pump, for the purpose of clearing and cooling the same. When the exhaust is completed, a valve admits the gases, which have previously been compressed by the pump for this purpose. —*The Gas Engineer.*

A BILL has been introduced in the New York Senate which assigns fifteen policemen to the use of the New York City Board of Health for work in the tenements, and provides that the Mayor, a member of the Board of Health, and representatives from the Departments of Public Works and Street Cleaning, and the Chief Building Inspector shall meet annually to recommend improvements in the tenement system.

Patents.

355,295. Sewer-Ventilating Furnace. Lyman L. Benson and William T. Stillwell, Kalamazoo, Mich. Filed April 12, 1886 Serial No. 198,533. Issued January 4, 1887.

355,318. Furnace. Everett R. Howard, Aurora, Ill., assignor of one-half to Roswell W. Gates, same place. Filed September 14, 1886. Serial No. 213,534. Issued January 4, 1887.

355,330. Underground Wire and Steam Street-Conduit. Sylvanus D. Locke, Hoosick Falls, N. Y. Filed July 28, 1886. Serial No. 209,294. Issued January 4, 1887.

355,331. Apparatus for the Manufacture of Gas. William F. M. McCarty, Philadelphia, Pa., assignor to Jane Logan, Hagerstown, Md., and Adolph Ohl and B. C. Lauth, Philadelphia, Pa. Filed December 11, 1885. Serial No. 185,379. Issued January 4, 1887.

355,345. Supply and Drain Pipe Connection for Washstands. William D. Schuyler, New York, N. Y. Filed December 9, 1885, Serial No. 185,190. Issued January 4, 1887.

353,347. Quarry Frame for Rock Drills. Henry C. Sergeant, New York, N. Y. Filed June 4, 1886. Serial No. 204,154. Issued January 4, 1887.

355,393. Gas-Stove. George H. Gregory, Brooklyn, N. Y. Filed February 23, 1886. Serial No. 192,905. Issued January 4, 1887.

355,439. Stationary Wash-Basin. John Demarest, New York, N. Y., assignor to the J. L. Mott Iron Works, same place. Filed October 2, 1886. Serial No. 215,115. Issued January 4, 1887.

355,487. Valve, Valve-Seat, etc. Robert W. Traylor, Richmond, Va. Filed February 27, 1886. Serial No. 193,488. Issued January 4, 1887.

355,488. Bucket Dredging-Machine. David Urie, Kansas City, Mo. Filed October 27, 1885. Serial No. 181,082. Issued January 4, 1887.

355,491. Cable-Hanger. George L. Wiley, Brooklyn, N. Y., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed June 19, 1886. Serial No. 205,613. Issued January 4, 1887.

355,515. Lead-Pipe Reel. Fred. Eitapenc, Binghamton, N. Y. Filed September 15, 1886. Serial No. 213,582. Issued January 4, 1887.

355,516. Gas-Meter. John A. Fardy, Brooklyn, N. Y. Filed September 3, 1886. Serial No. 212,631. Issued January 4, 1887.

355,586. Ventilating Cars. Joseph A. Buckley and Charles J. Koefoed, San Francisco, Cal. Filed April 21, 1886. Serial No. 199,706. Issued Jannary 4, 1887.

355,587. Ventilating Cars. Joseph A. Buckley and Charles J. Koefoed, San Francisco, Cal. Filed May 1, 1886. Serial No. 200,872. Issued January 4, 1887.

355,592. Oscillating Liquid Meter. William Cowan, Edinburg, Scotland. Filed July 26, 1886. Serial No. 209,147. Issued January 4, 1887.

355,629. Gas-Lamp. Francis H. Wenham, The Beacon, Goldsworth, Woking, County of Surrey, England. Filed December 3, 1886. Serial No. 220,583. Issued January 4, 1887. Patented in England February 3, 1885, No. 1,514, and August 11, 1886, No. 10,279; in Victoria, May 4, 1885, No. 4,049; in New South Wales, July 13, 1885, No. 6,757; in Russia, October 28, 1885; in South Australia, December 7, 1885, No. 629; in Queensland, April 20, 1886, No. 72; in Spain, June 10, 1886, No. 5,554, and in Denmark, November 1, 1886, No. 814.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 12. PUBLISHED EVERY SATURDAY.

NEW YORK, FEBRUARY 19, 1887.
LONDON, MARCH 5, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA.
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

CHURCH-BELL RINGING AS A NUISANCE.

THE connection of bells and bell-ringing with religious services is a very old one, and the sound of the church chimes, heard in proper places and at proper times, is one of the sweetest and most suggestive that the ear of man can hear. Nevertheless the ringing of church-bells or of chimes may be a nuisance, not merely in the sense that it is disagreeable, but in the legal sense, as being something which, by producing physical discomfort, renders the houses in the neighborhood unpleasant as residences. This was settled in the case of Harrison *et al. vs* St. Mark's Church, Philadelphia, tried in the Court of Common Pleas in 1877. In giving the decision of the court for an injunction restraining the defendants from ringing the church-bells, Judge Hare stated the law as follows: "A man may do ordinarily what he will with his ground, but he has no such dominion over the streams that pass through or the air that floats over it. The air and water are so far common property that no one can be entitled to do that which will render them a source of injury or unfit for the general use. As the atmosphere cannot rightfully be infected with noxious smells or exhalations, so it should not be caused to vibrate in a way that will wound the not less delicate sense of hearing. Light may be shut out, and odors measurably excluded, but sound is all-prevailing."

This does not mean by any means that the ringing of church-bells in cities is to be forbidden. It depends on the location of the church, the height above ground at which the bells are suspended, and the manner in which they are rung—*i. e.*, whether the strokes are five or six in a minute or eighty or ninety in a minute. In each case the question of fact must be settled as to whether real injury is inflicted. Setting aside entirely the question of legal liability, it would seem that, for church authorities, the Commandment, "do unto others as ye would that they should do unto you," if obeyed, is quite sufficient to prevent all controversy on this point. As a matter of fact, this consideration has influenced the action of many churches; for example, the reason why Dr. Hall's church in this city has no chime of bells is because it might prove an annoyance to the inmates of St. Luke's Hospital on the next block.

There is no necessity for the ringing of church-bells so as to produce distress or annoyance. Many churches have no bells at all, yet their prosperity and utility are none the less, and in all doubtful cases the benefit of the doubt should be given to the sick, the weary, the nervous, who look to Sunday as a day of quiet and of rest.

WARMING CARS WITHOUT FIRE.

WE are glad to find New York, Massachusetts, and other States considering the question of warming and lighting cars with the view of preventing conflagrations in railroad accidents.

Recently the Railroad Commissioners of New York, at the request of the Legislature, gave audience to those interested in the subject at their rooms in Albany.

One of the gentlemen, Mr. Sewall, explained an invention which he said had been in successful operation on the Maine Central Railroad for some time. Steam is taken from a locomotive-boiler or a boiler in a special car and conducted through the train in pipes. The connection between the cars is made with rubber hose with metal joints.

This is, presumably, a practical method, or one that can be made so. The joint between cars is the only drawback to successful methods of warming by steam. There are many patents on couplings and flexible joints and hose for this purpose, some of which have merit, while many of them are impracticable in ordinary use. We hope, however, the commissioners will be discerning enough not to condemn a principle because of some detail of construction, nor pay too much attention to the advocates of present dangerous systems, who, we see, were in force both at the Albany meeting and the meeting in the State House at Boston before the Legislative Committee.

Mr. C. T. Shepard, of Albany, proposed to heat cars and light them with electricity. The idea is to have a dynamo in each car to be run by the axle of one of the wheels. By the current water is heated so as to warm the car, and there is a storage battery in the plan to guard against long stops.

The power necessary to run dynamic machines from the axle of a car would, we think, make this scheme impracticable for heating, though, with storage batteries, it may be feasible for lighting. Still, we are of the opinion, a dynamo in a baggage or special car would do better for the latter purpose.

Mr. J. W. Cloud, of the Erie Railway, did not think any car could be properly heated and ventilated unless cold air is heated before it is brought in from the outside. The present system of heaters or stoves can be made comparatively safe. The trouble is that the heaters are built like egg-shells and break too easily. Steam-heating from the engine was also practical, he thought.

We agree most decidedly with Mr. Cloud in the necessity of introducing warm fresh air into a crowded car. As it is now, we know of no practical system of what may be called "indirect heating" for cars. At least 1,000 cubic feet of fresh, pure air, without dust and cinder, should be admitted to each railway-car, per capita, according to the full seating capacity.

At Albany the makers of the rival hot-water apparatus with boilers in each car had a chance to tell how good their own apparatus was and how dangerous the other fellow's was, each claiming that his apparatus would withstand the shock of collision without breaking open.

Master Mechanic Medway, of the Boston and Hoosac Tunnel Road, said the hot water heater suspended under a car was one of the worst contrivances the road ever used.

The commission has also heard the views of several persons on means of lighting, to which we will refer again at another time, and the offer of Master Mechanic Blackall, of the Delaware and Hudson Canal Company, of the use of a car for making experiments, wa promptly accepted.

Candles play little or no part in the setting on fire of cars unless kerosene-oil is present to spread the flame. It is the hot coals that fire the timbers, and it is the kerosene-oil that spreads the fire so rapidly that the people cannot escape. When a car is broken into splinters eight or ten gallons of headlight or some such oil is distributed over the clothing of individuals, the upholstery of the cars, the bedding, and the wood-work, and no reckless servant girl ever prepared more dangerous kindling than an overturned and smashed-up car is, which only requires the shovelful of hot coals to set all in a blaze instantly.

OUR BRITISH CORRESPONDENCE.

Scholarships and Prizes of the Royal Institute of British Architects—A Chair of Engineering at University College, Liverpool—Siemens' Underground Cable—The Electric Light on the Continent—Healthy Homes—The Building for the American Exhibition.

LONDON, February 2, 1887.

IT is announced by the Royal Institute of British Architects that the Owen Jones traveling studentship for the current year has been awarded to Sydney Vacher, Associate, and special prize in connection with the same to G. A. Audsley, Fellow. The Pugin traveling studentship is awarded to Thomas Maclaren, and medals of merit to Arnold Bidlake Mitchell and Edgar Selby.

A Chair of Engineering has been endowed in connection with the University College of Liverpool by a Mr. Thomas Harrison with the sum of £10,000 ($48,000).

Siemens & Halske are manufacturing a cable for use as an underground main for electric purposes. The centre conductor is surrounded by jute and then covered with wire, this again with jute, after which it is steeped in molten metal and then covered in lead, the whole being covered in with a coating of jute and bitumen and serving of iron tape. The first covering of wires serves for return current.

Electric-light installations for public service appear to be making headway on the continent. A small centre station, 50-horse-power engines, and a Gramme dynamo has lately been established in Beauvais, France, the light being supplied thence to private residences, etc. A subsidiary station is worked by a 6-horse-power turbine.

If architects and specialists in sanitary science generally would take a leaf out of the book of Professor Henry Robinson it would be of infinite public service in disseminating the knowledge of the primary sanitary laws so essential to the public health. I make this remark in connection with the fact that I see that Professor Robinson has just given a public lecture at Swanage on "How to Insure Healthy Homes." The lecturer insisted upon the necessity of abundance of light (for every hundred cubic feet one square foot of light), the necessity of water-tight cesspits where such were absolutely necessary, disconnection of the house and sewer and of the water-supply from the drains; also, of removing dust from rooms. The points insisted upon are all old ones, but it seems necessary to hammer them in again and again.

The building for the American Exhibition, which is to be opened in May next in Kensington, presents several peculiar features, the chief of which is the employment of old steel rails in its construction for columns, rafters, struts, and tie-bars, etc. The frame consists entirely of old rails, with the exception of the cast-iron sockets for the columns and steel shoes for connections. The columns consist of two rails riveted back to back standing in cast-iron sockets set upon cement. The long spans for the rafters are laid with two rails connected with fish-plates, short spans with one rail. This adoption of old rails is the plan of Mr. H. Wynn, the engineer of the Exhibition Company.

SAFETY-VALVE.

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

HOTEL AT PABLO BEACH, NEAR JACKSONVILLE, FLA.—THE LATE FREDERICK B. WHITE, OF NEW YORK, ARCHITECT.

THE subject of our special illustration this week is a hotel at Pablo Beach, sixteen miles from Jacksonville, Fla., on the coast. Mr. John G. Christopher is the owner. The building is a frame one, with a shingled roof and interior finishings of yellow pine. It stands 300 feet from the ocean, and accommodates 300 guests. The late Frederick B. White, of New York, was the architect, and the cost of the building was $45,000. The floor plan is given on page 288.

A RESIDENCE AT BROOKLINE, MASS.—E. A. P. NEWCOMB, ARCHITECT.

BRIDGES OVER NAVIGABLE STREAMS.

A CORRESPONDENT writes to us from Cincinnati: "The conduct of the managers in building a bridge across the Ohio River, between this city and Covington, for the Chesapeake and Ohio Railroad, indicates plainly quite as strong a desire to injure the navigation of the river as to provide accommodation for the railroad. The spirit is the same in the case of the proposed bridges at Cairo and St. Louis."

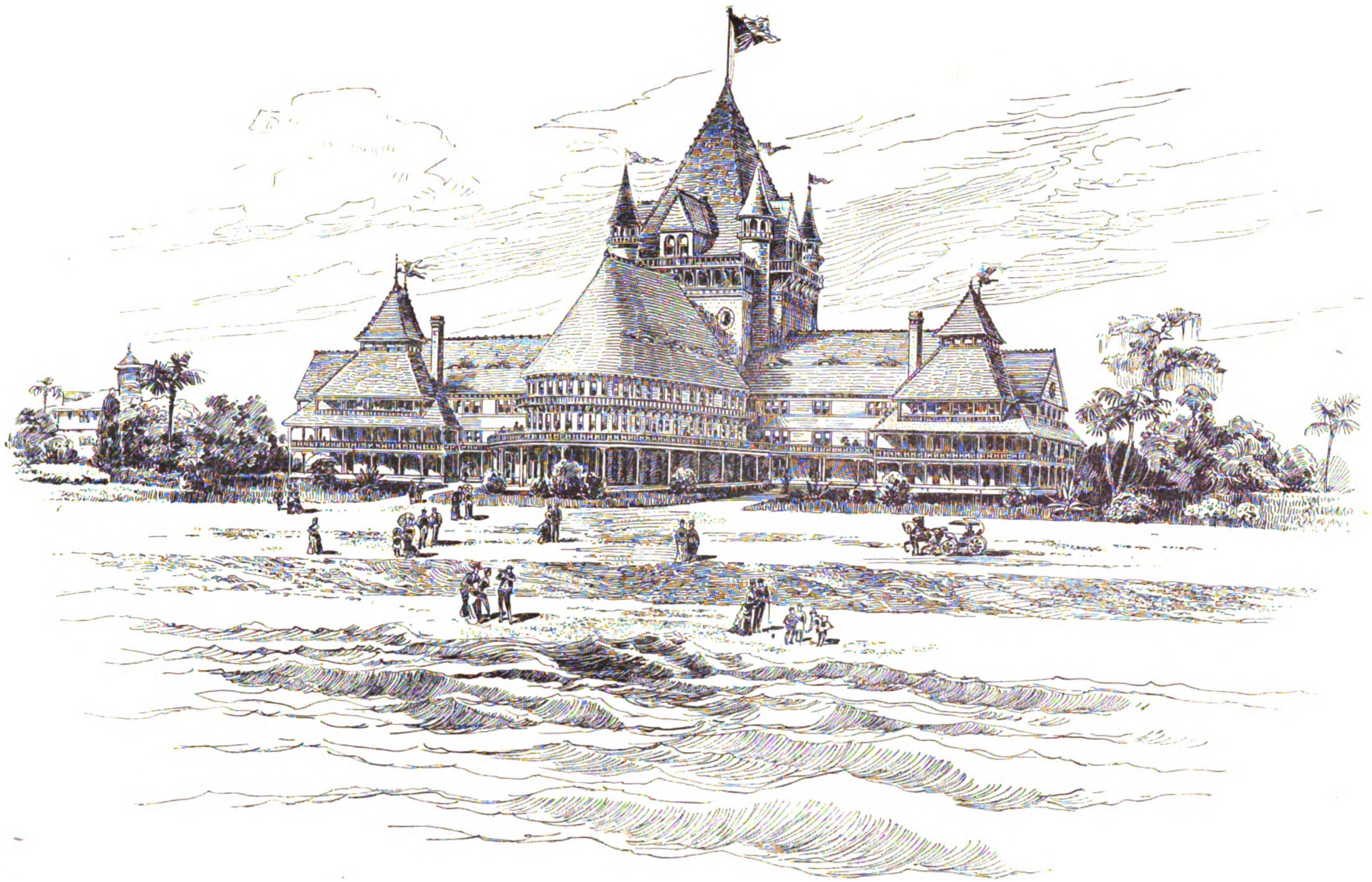
SCHOOL-HOUSE PLANS.—A bill has been introduced in the New York Assembly by Mr. Platt, of Poughkeepsie, appropriating $2,000 to enable the Superintendent of Public Instruction to procure architects' plans and specifications for a series of school buildings to cost from $6,000 to $10,000, with full working plans and specifications. The Superintendent is to prepare blank forms for builders' contracts, and to append suggestions as to the arrangement of the buildings with regard to lighting, heating, and ventilating, and the health of teachers and pupils. The plans are to be distributed to trustees who intend to build new schools.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A SUBURBAN RESIDENCE AT BROOKLINE, MASS.—E. A. P. NEWCOMB, ARCHITECT.

THIS house was built for Mrs. Georgia H. Bent on the corner of Longwood Avenue and Harvard Street, Brookline, Mass. It contains on the first floor a reception-hall, music-room, and dining-room, all finished in quartered oak, a parlor finished in sycamore, and a kitchen. The second floor contains five chambers and two bath-rooms; the third floor three chambers and an attic. The house is of frame construction, shingled. The architect is Mr. E. A. P. Newcomb, of Boston, Mass.

THE committee appointed by the Western Association of Architects to form a State organization in Kentucky met February 11, in Louisville.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

MURRAY HALL, PABLO BEACH, FLA.

FREDERICK B. WHITE, ARCHITECT.

THE NEW CROTON AQUEDUCT.

No. XIII.

(Continued from page 234.)

FOR the purpose of giving a clearer idea of the relative capacities of the proposed reservoirs formed by building the Quaker Bridge and Muscoot dams, as compared with the Croton Lake, we give the sectional view recently published by the Aqueduct Commissioners. The engraving shows clearly also the position of the several structures. The relative heights of the several outlets are shown by black spots. We recapitulate in part our description of November 13 last and previous issues.

The height of the dam is 277 feet above its base. The elevation of surface of ground in the valley at the dam is thirty-five feet above tide. The elevation of the new aqueduct at the bottom inlet is 140 feet above tide, and the additional storage obtained by raising the water in the new lake to that level is 6,377,935,000 gallons, or more than three times the present storage.

The level of the present Croton Dam is 166 feet, and the additional storage for the twenty-six feet *above* the new aqueduct and to the level of the old dam is 6,739,599,800 gallons, or nearly 3½ times the present storage.

The Muscoot Dam has a level of 200, and will store one and a quarter times the present amount. The same flow-line continued between the Muscoot and Quaker Bridge dams will store 20,760,400,200 gallons more.

The total storage when the new dam is built and the reservoir full will be 38,377,935,000 gallons, or nineteen times that at present stored by Croton Dam.

By means of the several inlets shown at the gate-house, the water can be drawn down to 140 feet. The blow-off at the dam will reduce it afterward to eighty-five feet, and there will be no difficulty in arranging to drain the lower lake entirely if desired. Should the emergency ever arise, the full contents of the lower lake could be made available, and in any case the arrangements will be such when the large lake is in use that a constant circulation will be kept up, and no part of the water will be allowed to become stagnant. The Muscoot Dam will be about 4½ miles by way of the channel above the Croton Dam, and the Quaker Bridge Dam about the same distance below the latter. The water will be set back by the dam some seventeen miles, and the total drainage area from which the water will be impounded will be 362 square miles. The water-supply insured will be 250,000,000 gallons per day.

There have been a number of pamphlets printed recently by the Aqueduct Commission to which we wish to refer. First, the Report of the Special Committee on the Construction of the Quaker Bridge Dam and Reservoir, dated January 31, 1887, in which the following resolution is presented for adoption :

"*Resolved*, That after careful consideration, this committee recommends to the commissioners the construction of the Quaker Bridge Dam, and that proper steps be taken to secure the land necessary for the site of the dam and for the reservoir."

The report is also important, as it gives a full list of the reports previously made which bear on the question. This is followed by a minority report from Judge James C. Spencer, of the same committee, against the immediate construction of the dam. Next is a reprint of the original report in 1883 of Isaac Newton, then Chief Engineer of the Croton Aqueduct, in which the Quaker Bridge Dam is proposed as a solution of the question of supply. Appended to this is the report of the consulting engineers endorsing the scheme. Next is a letter from Henry C. Pellew, Esq., endorsing the scheme as a taxpayer.

Next a report to the Commissioners by Professor C. F. Chandler, in opposition to the idea that the water will be unwholesome. He says that it is in every way satisfactory, and there is no legitimate ground for objecting to it.

Next a report by A. Fteley, Consulting Engineer, dated January 31, 1887, as to the dam itself as a structure, with a note as to its necessity. He says no system of small reservoirs will give a supply equal to the capacity of the new aqueduct, since they exclude a large portion of the drainage area of the valley. The volume of the river at times is reduced to a flow of 10,000,000 gallons only per day, showing the necessity for a large provision for storage. The consumption will increase also to a high figure the moment the present throttling down of the supply shall cease.

The most important feature of the dam is its magnitude. "The height is unprecedented, but, owing to the presence of eighty feet of water-bearing strata below the dam, the pressure of water on the up-stream side will be equal to that of a somewhat lower structure, and many of its general conditions are similar to those of existing high masonry dams, a number of which have successfully withstood the test of time."

The old and massive Spanish dams are not structures to be imitated. A mere accumulation of masonry presents no guarantee of stability.

The recent works by French engineers show a better understanding of the forces at work and an intelligent distribution of the masonry.

Two dams, the Vyrnwy near Liverpool, and the Gilleppe at Verviers, Belgium, have been cited as proof that the section adopted for the Quaker Bridge Dam is insufficient. As to the first, it is intended to be used as a weir, and is shaped to lead the water in its fall, and support a heavy apron on the down-stream side.

As to the latter, he says : "It is difficult, however, to give good reasons for its size, which is evidently excessive. An eminent Italian engineer says of it, it has an extraordinary section which is justified neither by theory nor special conditions."

The upper part of the Quaker Bridge Dam has a section equal (when not superior) in strength to the Ternay and Habra dams now in successful use. It has been necessary to depart from the limits of pressure adopted in the construction of the dams named, but the pressure is within the limits which obtain in other existing dams, and much below that in structures of a different character. In building the Furens dam this limit was fixed at eight tons per square foot by the French engineers, but in the Ternay dam this was considerably increased, and the opinion was expressed, "that experience will lead to a much bolder, although perfectly safe practice." The extreme at the inner and outer toes of the Quaker Bridge Dam, calculated by the De Beauve method, is 15 tons, and this is much inferior to that obtaining in other structures ; for example, that in the masonry at the roadway under the central shaft of the towers in the East River Bridge is 26 tons per square foot. The average pressure on the base of the dam is 10½ tons, and the writer disagrees with De Beauve, believing that the greatest pressure is central, and *not* at the toes.

The low limits of pressure adopted by the French were to provide for the contingency of incomplete setting of the mortars by the time the dam came into use, the hydraulic limes being slow setting. Our American cements are quick setting, and there is no danger of that contingency.

All contingencies of ice-jams, sliding, and overturning have been considered ; and it only remains that conscientious, careful work be obtained to insure perfect stability and a successful work.

The last pamphlet to be mentioned, dated November 29, 1886, contains "A summary of the reasons why Quaker Bridge Dam should be built," by Chief Engineer Church :

First—Is the unwarranted expense incurred for the New Aqueduct, unless the entire capacity of the Croton River be utilized.

Second—The small storage reservoirs, added above as the future may demand, are but details of a complete scheme of which the Quaker Bridge Dam is the great and principal requirement. Most of the storage thus obtained will be required at once to re-establish lost pressure in the city, and provide for a succession of excessive droughts. This result cannot be obtained by a number of small reservoirs, as it has been proven that the gathering ground is too restricted in area.

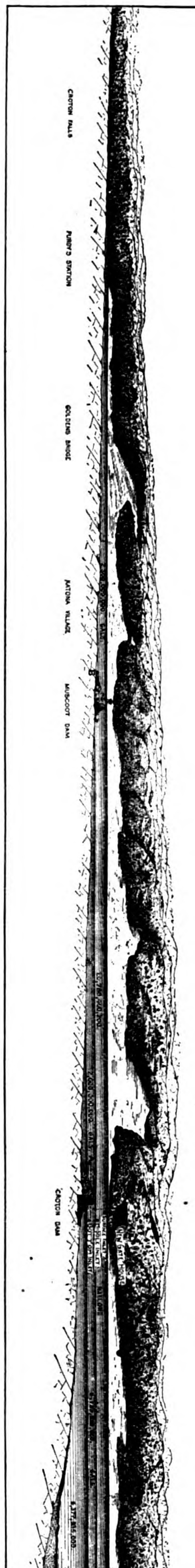
Third—The Croton River was selected because of the large increase of storage immediately demanded, and which could only be at once obtainable by means of the Quaker Bridge Dam.

Fourth—The dam built as proposed near the mouth of the river secures the greatest bulk of storage, the greatest area of drainage, and the purest quality of water, under the best control, and at least cost.

Fifth—The proposed dam with the Muscoot and Croton combine to preserve healthful conditions for the inhabitants of the Croton Valley, by keeping the bottom covered, and avoiding the necessity of drawing down the small reservoirs above, so as to expose muddy bottoms to the sun, as is now the case.

Sixth—Its immediate construction has been urged by the most eminent hydraulic engineers in the country as indispensable to the increased supply, if it is to be drawn from the Croton River.

Seventh—The aqueduct and the dam supplement each other and are mutually dependent.



QUAKER BRIDGE RESERVOIR

The aqueduct and the elaborate gate-house are half completed, and they will be of little use without the dam.

The revised estimate of cost is as follows:

Quaker Bridge Dam and appurtenances	$4,027,600
Muscoot Dam, etc	300,000
Roads and Highways	410,500
Bridges	415,000
Railroad changes	190,000
Clearing Basin	200,000
	$5,543,100
For 4,000 acres of land	1,200,000
Total	$6,743,100

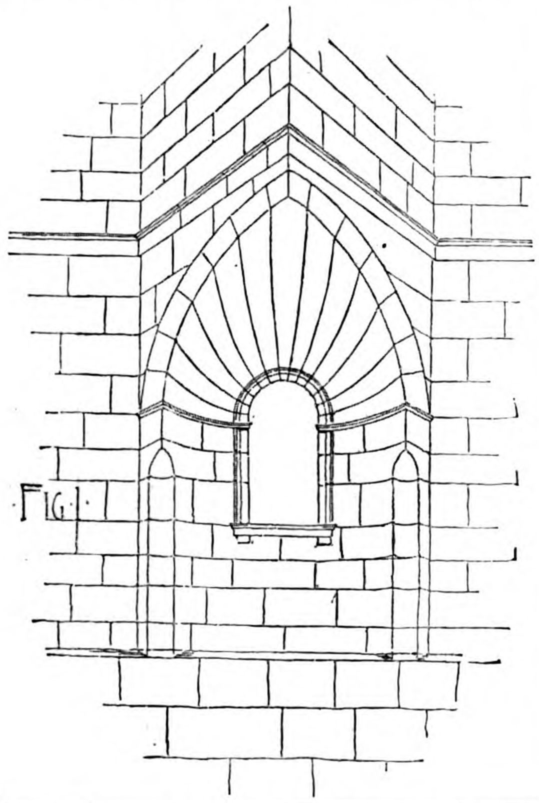
(TO BE CONTINUED.)

BUILDING CONSTRUCTION DETAILS.

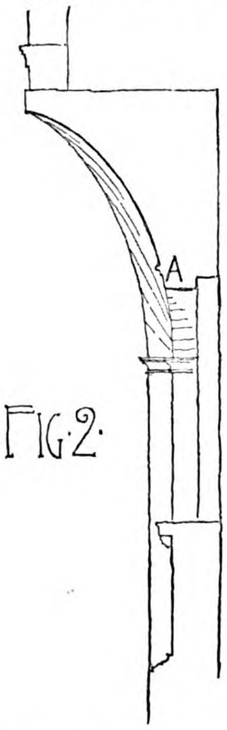
No. II.

(Continued from page 111.)

AMERICAN architects and builders seem to have an habitual distrust of stone-work; and, judging by what we see about us every day in any large city, we certainly never have half realized the possibilities of good cut-stone work as a factor in the construction of large and complicated building operations; and this notwithstanding the fact that nowhere else in the world are Nature's choicest materials placed so conveniently at the hand of the builder as here in the United States. The force of this statement may not appear at first thought, for a great deal of stone is actually used in our buildings; and it is only by considering how the material is used, or, better yet, the extent of its application in other countries, that one can appreciate how timidly it is adopted here. Americans surely have not the reputation of showing any lack of daring in their building operations; still we have yet to learn the true value of the arch and the vault as elements of construction. In other times, when iron was never dreamed of as a building material, every arch and corbel had its true meaning. Now, one is generally compelled by law, no less than by custom, to make the arch a purely architectural feature, the real burdens being borne by iron beams. With the aid of the stronger material some most startling constructions are evolved. It may, then, be of interest to notice a few of the constructions which have been worked out without the use of any iron whatever.

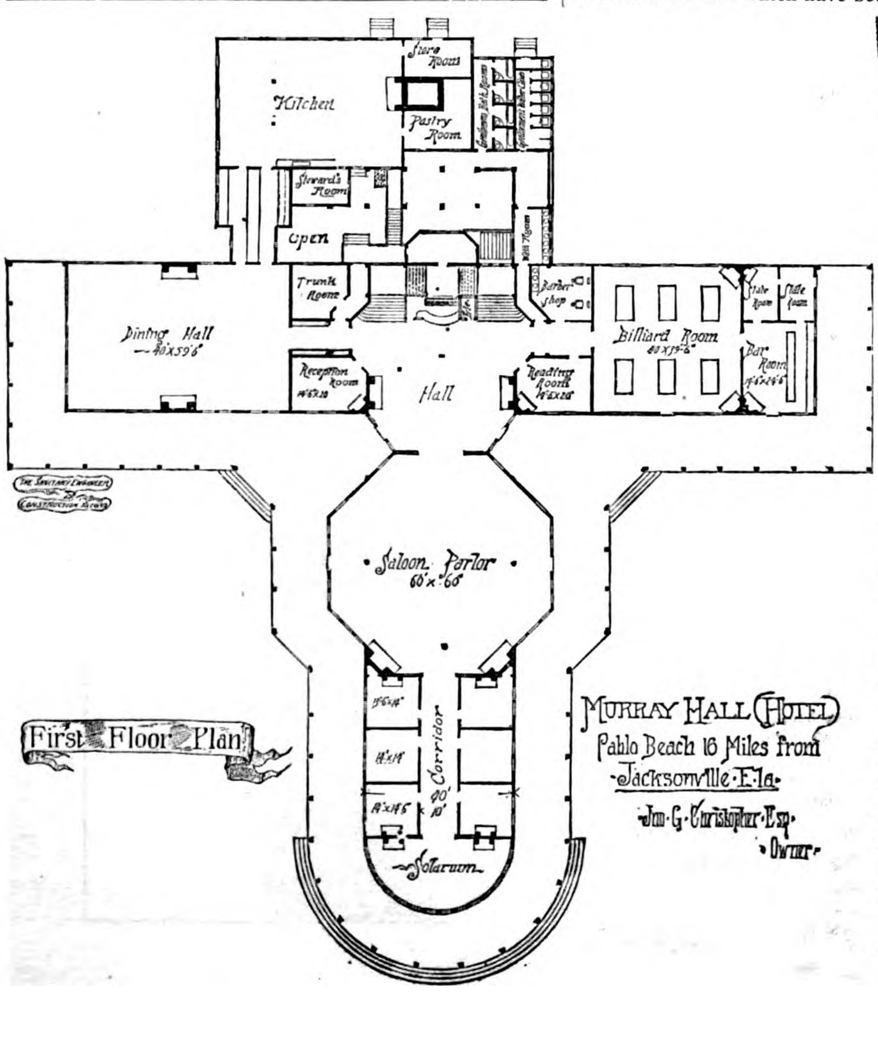


·FIG·1·

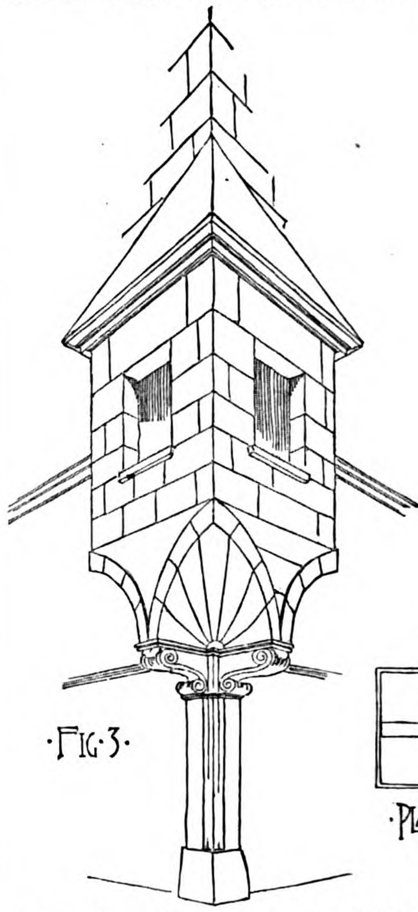


·FIG·2·

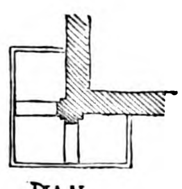
Some years ago, in the course of the improvements which have made Paris the city it now is, a street was prolonged in such a manner as to cut off a considerable angle of one of the buildings pertaining to the Banque de France. Wishing to preserve the upper story, and yet being obliged to leave an open passage underneath, the architect made use of a construction which is seldom met with in modern work. The Fig. 1 will serve to approximately illustrate this. The wall below continues each side indefinitely, and is somewhat less than two feet thick. The walls above are at an angle of forty-five degrees to those below, and the corner projects fully seven feet. The overhanging masonry rises to a height of about fifteen feet above the string-course, and is supported entirely by the trumpet-vault or arch. A section through the centre of the arch is shown by Fig. 2.



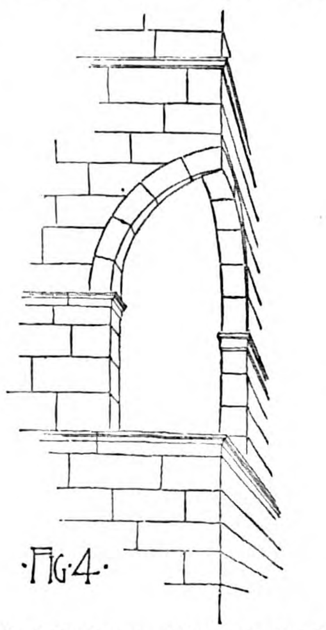
The voussoirs extend clear through the wall, but there is no other attempt at anything like counter-balancing, nor are metal ties used in any way. Even the level courses above give no other tie than is afforded by their own weight. The principle of stability involved is, however, not difficult to understand, and as in a great many apparently complicated constructions, a little common sense will serve more to elucidate the problem than any array of calculations. The arch-stones are carefully keyed and laid with as fine joints as possible. Were there any tendency to fall, movement would take place about the lower edge of the keystone at A, Fig. 2, the top of the stone dropping down and out. But as the stones are carefully keyed, such movement cannot take place unless the arch is forced in at the haunches or out at the feet. The load above effectually counteracts any weakness at the haunches and the heavy wall below receives and absorbs all of the thrust. Moreover, the shape of the arch is such that the resultants of the thrusts fall quite within the lines of support, whence there is hardly any pressure normal to the wall, and the whole construction is as secure as an ordinary arch in a plain, straight wall.



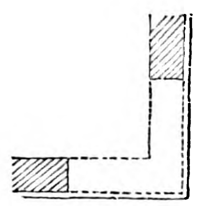
·FIG·3·



·PLAN·



·FIG·4·



·PLAN·

The same kind of construction exists on the apsis of the Church of St. Sulpice, Paris, where a huge circular bay some 22 feet across is corbeled out about 8 feet over the street. In this case the arch was so wide that the voussoirs could not be in single stones, and they are accordingly laid in lengths of not over four feet, but the principle involved is exactly the same as in the previous case.

Figure 3 is a sketch from memory of a bay-window on the corner of a house in the Quartier du Marais, Paris. The bay is only about six feet square, and the whole construction is so light that the adhesion of the mortar would seem almost sufficient to keep the stones in place; but there is evidence that the work was intelligently planned upon principles which may readily be applied to much heavier construction. Here the support is afforded by three equal trumpet-vaults, springing from the wall and from two heavy stone brackets. Exactly the same reasoning can be followed as in the first instance. The stones all key, and the corners can settle only by pushing back the haunches or crushing a stone. The feet of the arches thrust against each other, so that there can be no outward movement. The same construction could be applied if the bay were entirely detached from the house-walls and supported on an isolated pier; by adding the fourth trumpet-vault the arches would take up each other's thrusts, and all the strains would be resolved into a single vertical pressure at the centre. A construction of a somewhat different nature, which is often seen in the old masonry-work of the French towns, is that illustrated by Fig. 4—an arched opening on the corner of two masonry walls. The most extreme example of this nature which has come under the observation of the writer is an opening eight feet wide on the angle, in walls barely a foot thick, which are continued about 25 feet above the crown of the arch. This construction is not as purely scientific as the others we have considered, as more dependence is placed upon the mortar and the inert mass of the masonry. Indeed, it is rather difficult to analyze the stability of such an arch and fully determine why it does not fall, but it is evident that the greater the load over the centre, the more firmly are the voussoirs pressed together, and the less tendency is there towards any outward movement. Failure would take place by the crown of the arch being pushed out bodily in the direction of a line bisecting the angle formed by the two walls. The only resistance to this is what is obtained from the adhesion of the mortar. The amount of strain can easily be computed for a given case, and is relatively smaller than might be supposed; still, it is only by considering the superimposed masonry as being united by the mortar into a homogeneous mass that the construction can be called perfectly secure.

The foregoing examples are perhaps extremes of construction in some respects, and are not such as one would most willingly copy; but they at least show the possibilities of *bona fide* stone-work.

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

No. III.

(Continued from page 263.)

Building-stones may be divided into three general classes: First, the different varieties of granite and granitic rocks; second, the marbles, which may have a coarse or granular structure, and may be either limestone or dolomite or serpentine; third, the sandstones, which may be composed of material having an organic, an argillaceous, a ferruginous, a calcareous, or a siliceous binding material. Slates are occasionally used in building, but not frequently. They are subject to peculiar forms of decomposition when they are used as roofing material, about which little need be said, because the decomposition which they would undergo in such very thin sheets would hardly take place when they are used in thick pieces in the construction of an ordinary building. Besides these stones, there are a few others which are sometimes used in the vicinity where they are found, such as various kinds of trap or basalt and serpentines; also steatites, and some other very soft rocks. Their use, however, is not common. Each of these stones is subject to its own particular kind of decay, which may be either chemical or mechanical.

Granite is made up of quartz, feldspar, and mica, and is considered entirely impervious to moisture, and, until the two great fires of Chicago and Boston, was believed to be an almost indestructible rock. Recent investigations have shown that it contains within itself many elements of destruction. Of the minerals which compose it, quartz is the only one which is not liable to be represented by several species. While orthoclase is generally the principal feldspar of this rock, it may be replaced in part or in whole by microcline, oligoclase, labradorite, or albite. The mica may be muscovite or biotite, and possibly other varieties. The accessory minerals which either accompany it, or in some cases replace almost altogether some one of the regular constituents, are amphibole, pyroxene, epidote, tourmaline, and in certain varieties of Swedish granites, achmite. On the other minerals, it is estimated that nearly two-thirds of all the known mineral species are found in sienitic rocks. At least ten of these accompany, in more or less large quantities, most granites. These are garnet, titanite, zircon, apatite, magnetite, menaccanite, hematite, pyrite, pyrrhotite, and rutile. The variety of the species of feldspar and mica, as well as the way they are put together in the stone, changes both its appearance and its physical qualities. As the quartz is the hardest of the minerals, it might be supposed that it would give its hardness to the stone. This mineral, as it occurs in the interstices between the feldspar, seems to have been formed last. It is everywhere more or less granular and brittle, so that while it is harder than the feldspars, it does not make the rock hard. Crystals which are themselves quite friable, may be separated from it by slight taps of a pointed tool. There is in the School of Mines' collection a beautiful mass of epidote crystals, two or three inches long, from New Hampshire, which when it arrived was entirely embedded in quartz, and was separated from it in this way. The feldspars are the minerals which give both the character and the hardness to the rock. This is due almost entirely to the condition of the feldspars, and although the quantity contained in two specimens may be the same, the character of the rock may be entirely differentr. When the crystals are distinct, and present highly polished cleavage faces, the rock will be hard; when, on the contrary, they are lamellar and loosely aggregated, the rock will be soft. Not only are the granites of different hardness, but they possess different rates of expansion under heat, which, as will be shown, is one of the principal reasons for their disintegration. The power of absorbing water is also quite different. The amount of water likely to be absorbed by a well-dried granite is a little less than 1 per cent., but when it has been exposed a very long time to a hot, dry climate, and has become slightly disintegrated, it will, as shown by experiments made on the London obelisk, absorb several times that amount. This water, and the different rates of expansion of its constituent minerals, is the reason why granite spalls in cases of buildings exposed during large conflagrations. Granites are also of different degrees of fusibility, depending on the quantity and the kind of feldspar contained in them; those containing albite are much more readily fusible than those containing orthoclase, all the more so if the albite is, as it often is, in thin lamellæ. The amount of mica present will also influence both the texture and the durability of the stone. If it is scattered through the rock, about evenly diffused, and not in too large quantities, the rock will be strong, if the feldspar crystals are of the proper character. If it is in bunches it will render the stone weak where the bunches occur. If distributed in directions which are parallel to each other, it may make the rock so weak as to give it a tendency to cleave in the direction of the mica planes.

The presence of hornblende minerals does not seem to affect the strength of granite rocks, except so far as, after very long periods, it is liable to certain kinds of decomposition. It does not generally occur in planes arranged in given directions, and is rather in long crystals of a more or less fibrous nature scattered through the rock. Its fracture is somewhat fibrous, so that it seems rather to tend to consolidate than to weaken the stone. The granites containing hornblende are amongst those which have longest resisted decay and disintegration. It replaces the mica forming the famous syenites which were so much esteemed as building materials by the ancients. When hornblende is replaced by pyroxene, the rock is not durable. Pyroxene is much more brittle and breaks with a much more granular fracture than the hornblende minerals. It does not tend to form fibrous masses, so that the rock is much more brittle than those containing the hornblende minerals. Some New England granites are liable to chip and break, owing to the presence of this mineral, which, whenever it is bunched, is liable to crack out in nodules, or when it is in considerable quantity, evenly distributed, to make the stone brittle as a whole. These two minerals exist together in certain granites, which are then all the stronger, as they contain less pyroxene. When the rock contains hornblende alone, it is usually very tough. The feldspar present in such cases is almost invariably orthoclase, which, as it is the soundest and most permanent of the feldspar family, makes the stone a very desirable one.

It is very generally believed that granite cannot decompose. The kaolinization of the feldspar goes on with exceeding slowness, and, except under conditions very favorable to it, would not be likely to have much influence for many years. Not so, however, with the other minerals which compose it. The quartz is often full of microscopic bubbles, carrying liquids liable to freeze by cold or to be transformed into gas by heat, so as to produce a maximum of tension. The least space between the minerals would thus tend to become widened by the lapse of time. When the mica is biotite, the rock is more liable to decay on account of the ease with which this mineral decomposes. When it is present in large quantities, it makes the rock tender from the readiness with which it cleaves. When it is stratified it makes parallel lines of weakness along which the stone splits. The quartz contained in the rock is usually full of cavities, some of which are microscopic and others macroscopic, which may disintegrate the quartz, either by the expansion of the liquid by heat or cold, and thus render the rock itself more liable to absob moisture than before. Independently of all this is the general change in the structure of all granites when exposed to very great variations of temperature, which cause minute fissures along the lines of least resistance, which are constantly increased in width and depth, causing the stone to become weakened and finally to disintegrate. This is most frequently seen in granites in which the triclinic feldspars occur, and is most prominent in them when the crystals are large. The rate of expansion and contraction being different in three directions, when the variations of temperature are very great, cause separations to take place along the lines of cleavage of the crystals, which is the line of least resistance, which very soon produces irregular lines of weakness. These are rarely apparent to the eye, and may have been developed to a considerable extent without the possibility of detection, except by a microscopic examination, which is very rarely made. Examples of this are to be seen in the obelisk of Luxor, the one on the Thames embankment, and the one in Central Park, which are disintegrating rapidly, and in a few score of years, if left exposed, will probably be beyond remedy.

The decay which takes place in the granites is either chemical or mechanical. If chemical, it is either the result of the very slow decomposition of the feldspars and micas of which they are composed, or else of some mineral contained in the granite which decomposes easily, and by its swelling either causes the stone to flake, or by its decomposition to become porous and leave the stone free to be mechanically acted upon by frost and rain. If mechanical it is the result of the weakening produced along the lines of least resistance by the continued expansion and contraction of the stone where it is exposed either to very great, but gradual changes of temperature, or to sudden ones often repeated. This causes the stone to disintegrate, and is a simple mechanical action without any chemical change. Such weakness has been developed in some granites from this cause, as to produce considerable chipping of the stone in the quarry. It frequently occurs in the granites of New England to such an extent as to almost convert the exterior of the rock to sand, or to break it up into very small pieces, so that it can be easily removed without blasting. If, in addition to this cause of mechanical weakness, the rock should contain pyroxene, it would be safer to reject the stone. The power of the action of frost is much greater than is usually supposed. It takes a long time for frost to enter any considerable distance into the interior of a stone. When it has once entered, it takes a much longer time to thaw out. I have known of cases where granitic rocks which were quite warm on the outside, where they were exposed to the sun, froze solid liquid cartridges introduced into the drill-hole to blast the rock. In this case there was the rock in front, which had expanded by the heat at one rate, the rock behind, which was expanded by the frost at a different rate, both forces acting at same time, both tending to weaken the stone. Such effects do not act to any extent when the stone is in constructions, but it may have acted previous to its being placed there, and have seriously weakened it. Such disintegration takes a very long time; has not been observed to any great extent, so far as my knowledge goes, in the building materials of this country, except in the quarries; and is easily provided against by a careful selection of the stone. It is, however, very common in some of the outcrops of quarries, especially in those granitic rocks which contain a very large proportion of mica, which mineral, as it is very easily cleaved, is always a source of weakness; especially so when it occurs arranged in parallel planes, or contains substances likely to undergo a chemical change. In many instances granites have been discarded by our architects as building material because they do not resist fire. It is, however, not fair to judge of the quality of a granite by its more or less great fusibility. Granites exposed to the air always contain moisture. All of them are fusible, and all will spall and crack under the influence of such intense blow-pipe heat as occurred in the great fires of both Boston and Chicago. No other building-stone would have resisted those fires any better, for the limestone would have been burned to quick-lime, as they did, and the sandstones would have disintegrated in the same way. There is, however, great choice to be had in the selection of granites, on account of their mineralogical constitution, and the composition of the minerals which they contain. The amount of decay of which they are susceptible is the least of all natural stones, except some of the sandstone which have a siliceous cement. Granite to be used as a building-stone should be of uniform grain, free from dark spots or aggregations of minerals in bunches. It is all the better where there are the fewest number of minerals, especially of the triclinic feldspars or larger mica-plates, or pyroxene contained in it. It should especially be free from iron compounds, which are likely to oxidize. The decompositions of any kind, whether chemical, physical, or mechanical, are very slow, and take place for the most part only in stones which a careful examination would have caused to have been rejected from the outset. A good granite will last for ages, but no granite with very large or very irregular sized feldspar crystals, or minerals likely to become oxidized, will last. It may even be said of bricks that when they are improperly burned, or made of a poor quality of clay, they will exfoliate, fall to powder, or even be dissolved, while some of the Roman brick-work has stood for two thousand years, and is still in good condition.

Gneiss is formed of the same constituents as granite, and is subject to the same causes of disintegration, only in a much higher degree, as the more or less of lamination, which is due to the arrangement of the mica, causes it to split easily. There is every possible gradation of rock, from a recognizable granite through gneiss to a mica slate, depending on the relative abundance of the different minerals. Owing to the presence of so large an amount of mica, and that it frequently in addition contains a considerable amount of pyrites and other sulphides, it is likely to be a perishable stone. This is seen frequently in the rock of New York Island and elsewhere, where the rock is so soft on the surface that it is frequently possible to remove it to a depth of several feet with a pick and shovel. Generally, when hard stone is reached after the removal of such a surface, the rock is worthless for several feet below, and will go on disintegrating if put into foundations or struc-

* A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

tures of any kind. I have seen slabs of gneiss four feet long by a foot thick, in retaining-walls, so thoroughly disintegrated by the decomposition of the pyrites it contained, that it could be picked to pieces with the nail. These kinds of decomposition are constantly seen in the repairs to the foundations of old houses and sometimes in structures, but generally as such stone is buried it attracts but little attention. In retaining-walls, whole sections built in the upper part of this city have become so weak in less than twenty years, that they have had to be rebuilt. It is also liable to exfoliation when set in the structure in such a way that the mica planes are subject to the action of heat. Occasionally, when the plane of the stone is at right angles to the quarry-bed, the quartz, or feldspar, when embedded in mica so that it is on all sides of it, will chip out. Generally, when properly used, if the stone has been carefully selected, it is a durable building material.

(To be continued.)

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XII.

(Continued from page 260.)

Carson's Trench-Machine.

One of the first and most evident signs of sanitary improvement undertaken by town or city is the tearing up and blocking of the public thoroughfares for the purposes of laying water or drain pipes or the building of sewers. In narrow streets the long piles of material taken from the trench and heaped on one or both sides of it frequently cause a suspension of traffic; and in wide streets more than half the roadway is taken up in this way, and much delay is caused to travel. In London, and other large European cities where this is not allowed, the material is carted off as soon as thrown up from the trench, and has to be brought back again for refilling the trench when the work is complete. This causes extra expense from the double handling of the material, besides the inconvenience and delay caused to all street traffic. The work is also delayed in this last case, because, to obviate carting so much material, the trench is restricted to the smallest dimensions, and on account of the restricted room the work is done at great disadvantage. In many cases tunneling is resorted to wherever practicable, even for small depth.

Within the last few years a large amount of important sewer-work has been carried on in several cities of the United States, where, it is claimed, many of these inconveniences have been obviated, the cost of the work greatly reduced, and its progress largely increased by the introduction of the Carson trench-apparatus, which we propose to describe in the present article.

In the construction of the system of intercepting-sewers in Boston, Mass., the city had occasion to build a 3'x4' 6" brick sewer through Causeway Street, one of the most crowded thoroughfares of the city. There are three railroad stations on the street, two of which, the Lowell and Eastern, have no other access and are located side by side. The street also crosses the track of the Boston and Maine Railroad just in the rear of the depot, where every train blocks the street for a few moments during its make-up as well as on its arrival and departure. There are two lines of horse-car tracks in the street beside a freight track. The work on the sewer was to be done in the middle of the summer, when the flow of passengers coming to their daily business and returning to their summer homes was at its maximum. It was consequently of the greatest importance not to impede the roadway any more than was actually necessary and to leave all possible openings for crossing over the trench. The work lasted some four months, and was accomplished with the aid of the Carson trench-machine without at any time closing the street to traffic. The trench was five feet wide and seventeen feet deep, and was bridged over with planking at the entrances to depot-yards and freight-houses to allow teams and pedestrians free passage.

The machine (see Figs. 46 to 49), consists of a certain number of wooden frames some fourteen feet high and seven feet wide set about sixteen feet apart and connected together at the top, and at each side at the bottom. The legs of each frame are fitted with flanged castors which roll on a flat iron track laid on the sides of the trench. Brackets are suspended from the top of the frames, to which is attached an overhead rail or track on which the iron travelers are propelled. The travelers are shown in Fig. 48, the right-hand one being partially taken apart to show the interior arrangements.

The tubs are suspended to them by means of small wire ropes terminated by an iron eye-bolt B, with conical shank. Each tub, which is iron-bound, has one fixed and one movable bail at right angles to each other. The hook on the movable bail has a slide ("tub-slide") which engages into a slot in the fixed bail, thus preventing the tub from tipping. These are shown in detail in Fig. 48. In order to dump the tub it is only necessary to raise this slide and disengage the fixed bail.

When the apparatus is set up over a sewer or other trench, there are several travelers on each rail connected together in trains by rods so as to be about eight feet apart and allow the different tubs to be let down between the braces of the trench-sheeting. At the front end of the machine (or where excavation is progressing) is a hoisting- the whiffletrees of a carriage. By means of it the hoisting ropes are kept from twisting, etc.

Supposing a set of empty tubs to be brought over the excavation: at a signal these are lowered into the trench, taken off the ropes, and a set of full tubs hooked on. The engineer starts his drum and the loaded tubs begin to rise until they reach the carriers; here the cone part of the eye-bolts raises a pair of jaws, shown in the right-hand traveler, Fig. 48, and passes by them; the engine is stopped, and in letting off the tension on the ropes the cones all come down to a bearing on top of the jaws,

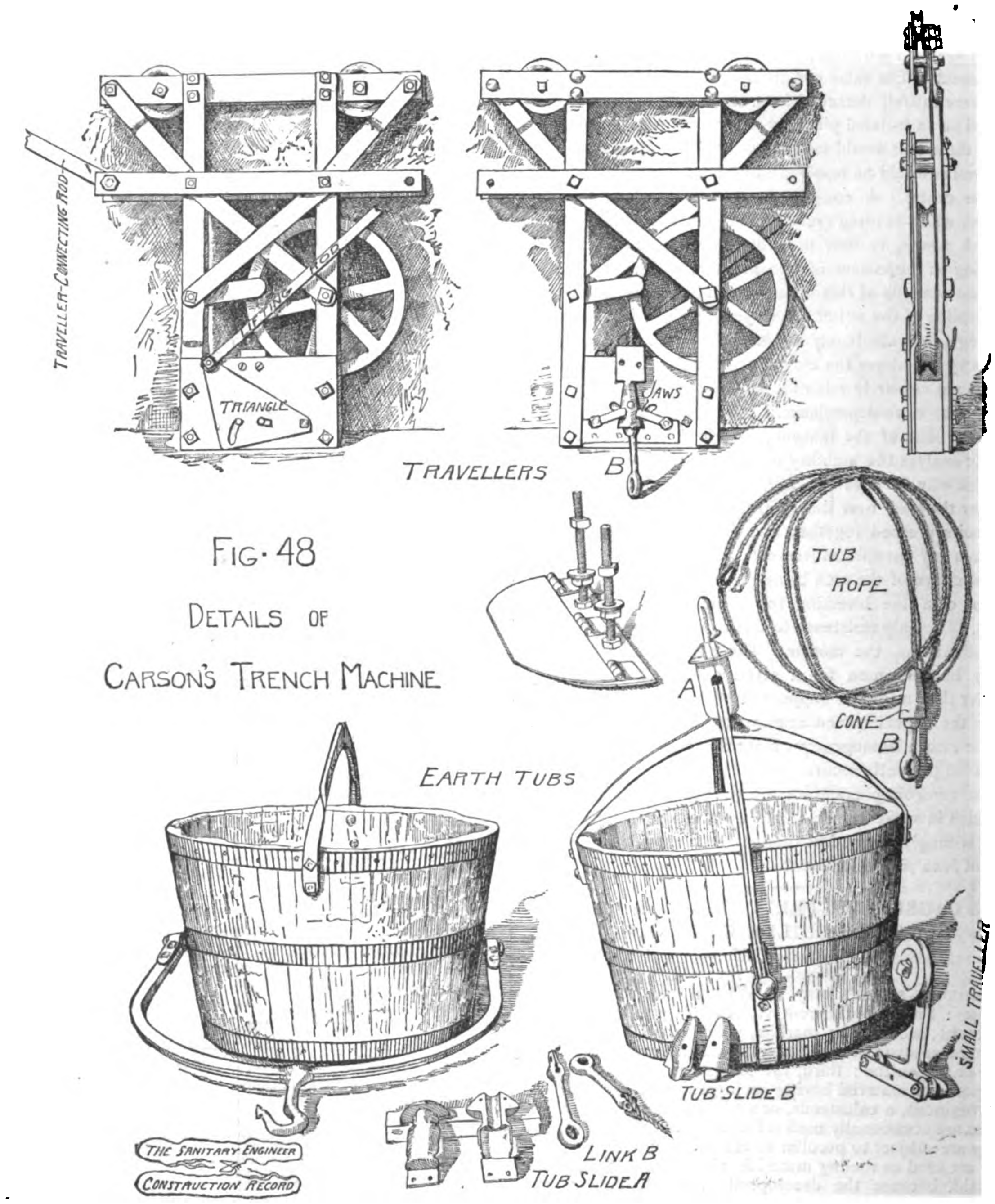
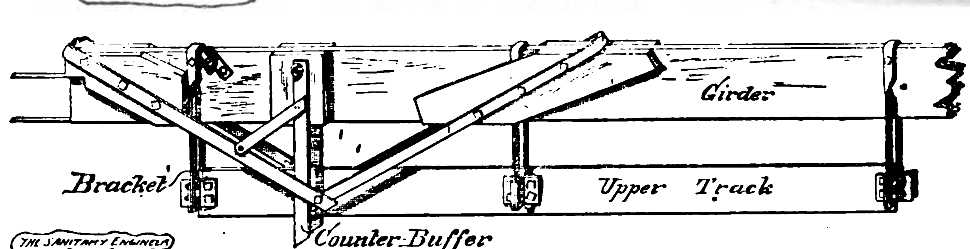


Fig. 48
Details of Carson's Trench Machine



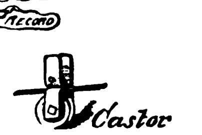
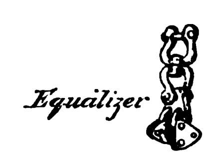


Fig. 49
Details of Carson's Trench Machine



engine and boiler on a truck connected to the rest of the frame-work. The ropes from the drums are carried over head-blocks fastened to a projection of the frame-work and run back to the travelers. Before reaching these, however, the rope divides into as many small hoisting-ropes as there are travelers. They are all joined to the main rope by the equalizer shown in Fig. 49, and this is suspended to the small traveler shown in Fig. 48. The office of the equalizer is to equalize the strain on the hoisting ropes where the lengths or loads vary, and it acts on the same principle as

and the tubs are then securely fastened to the travelers. In the meantime the other train of travelers has been at the rear of the frame-work and its tubs have been dumped.

At a signal from the boy in charge the engineer starts his second drum and draws the empty tubs towards him.

The two sets of travelers are connected by a tail-rope passing over a pulley at rear of machine, so that in drawing the empty tubs towards the engine the full tubs are drawn to the rear. When the empty tubs get over the open trench a projecting arm on the rear traveler strikes a

buffer-plate on one of the frames (see Fig. 49) and the train stops; at the same time the cones are raised off the jaws. Then a boy in charge raises all the jaws by means of a lever connecting the jaw-plates on all the travelers, and the tubs can be let down in the trench. The full tubs that were taken to the rear are there successively dumped over the completed sewer by raising the slide on each hook, and thus the trench is refilled with the excavated material as the work progresses. For any surplus material there is a wooden hopper at one part of the machine under which a dump-cart is backed, and the tubs are emptied into it as they pass along. As the work advances the whole machine is drawn ahead by means of a block and fall made fast to

Fig. 46

Carson's Trench Machine,

as used on Causeway St. Boston

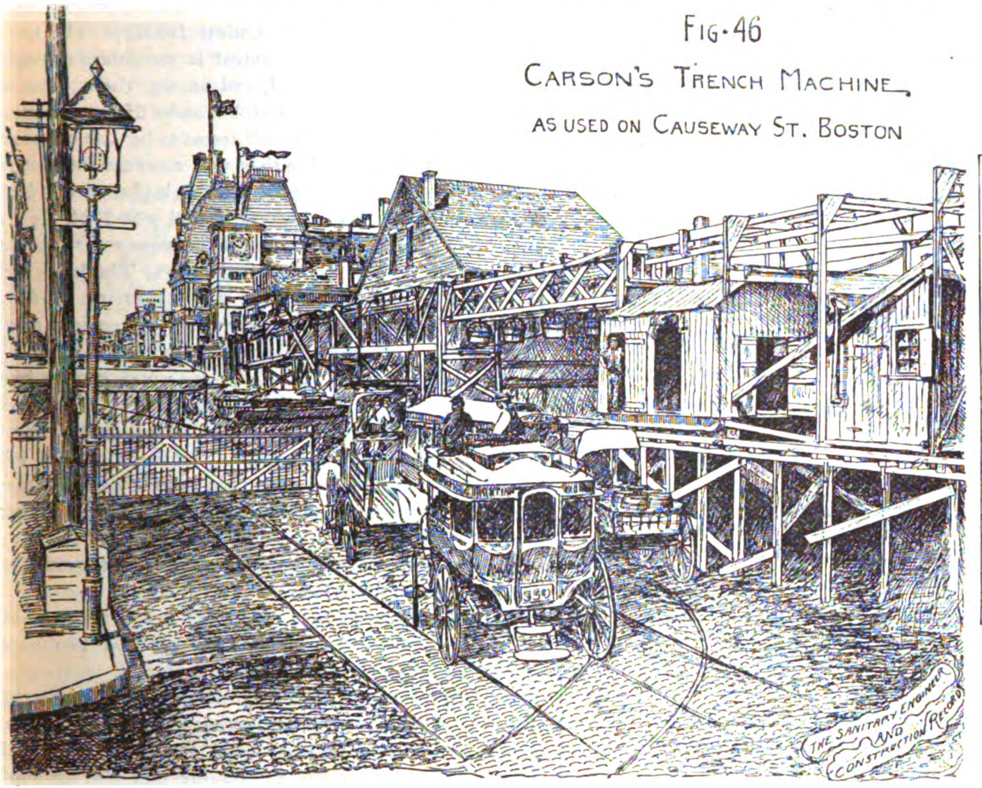


Fig. 47. Sectional View of Carson's Double Track Trench Machine.

a bar driven into the road-bed ahead of the engine and the rope is wound up on the windlass of the engine. On Causeway Street, owing to the extreme height necessary to allow trains and locomotives to pass through the machine, the track each side of trench was raised on bents seven feet high set across the trench; and for the long spans across the tracks and entrances to freight-yards some of the frames were left out and a truss carried over to support the upper track. The bents and side tracks were put up only while the machine was to be moved ahead across these openings.

It will be seen that besides the advantage of leaving the roadway clear of obstruction due to piles of earth and materials, Carson's trench-machine obviates all rehandling of materials for refilling the trench, since when once in the tubs it is carried directly back and dumped over the completed work. It also obviates all throwing of dirt up and over bearings, since the tubs can be set near enough so that the two men usually employed at each tub can shovel right into it.

The Carson trench-machine was also used in the construction of the Lynn intercepting-sewer, on Broad Street, William C. McClellan & Co., contractors. The trench in this case was 48 feet deep.

For narrow trenches, single-track machines are often used, and if the street is on an incline, gravity machines are used, in which case the full tubs run back to the dumping end of machine, by gravity, and a single drum on the engine suffices. This description is necessarily incomplete, but parties desiring it can obtain full knowledge by application to the patentee, H. A. Carson, 68 Devonshire Street, Boston, Mass.

There can be no doubt that this machine is worthy of investigation by those engaged in this class of work. Like all devices, however, it is better adapted to some cases than others, and judgment of the engineer should be sought as to which.

It is claimed that under very favorable circumstances 245 cubic yards have been excavated in ten hours, with eight shovelers, one engine-driver, one fire-boy, one dump-boy, and one signal-boy.

(To be continued.)

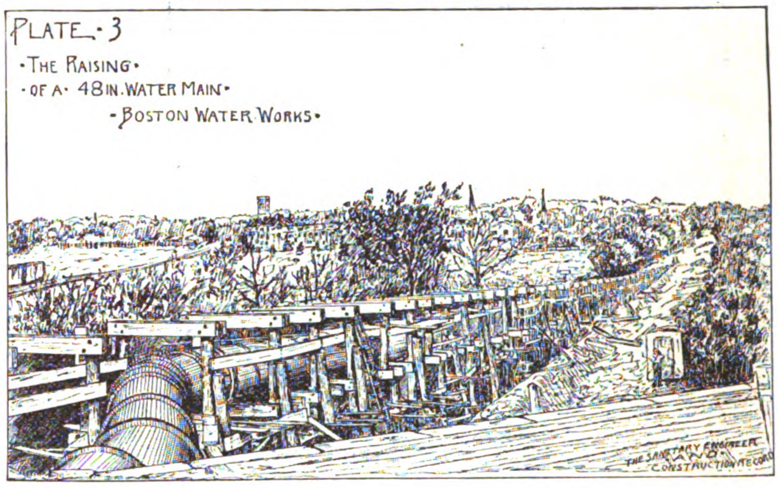
THE RAISING OF LARGE WATER-MAINS.

It frequently happens that changes in the grade of streets necessitate the raising or lowering of the water and gas mains. Where the pipes are of small diameter or the change in grade slight this is not a matter of much engineering interest; when, however, the change in grade is large and the pipe is one on which a large population is dependent for its daily supply, the question becomes of great importance.

The method adopted in Boston in a case of this kind is deemed sufficiently novel to warrant the publication of the following description of the methods employed. By reference to the plan and profiles (Plate 1) it will be seen that Beacon Street and Brookline Avenue both cross the line of

Plate 3

The Raising of a 48 in. Water Main. Boston Water Works.

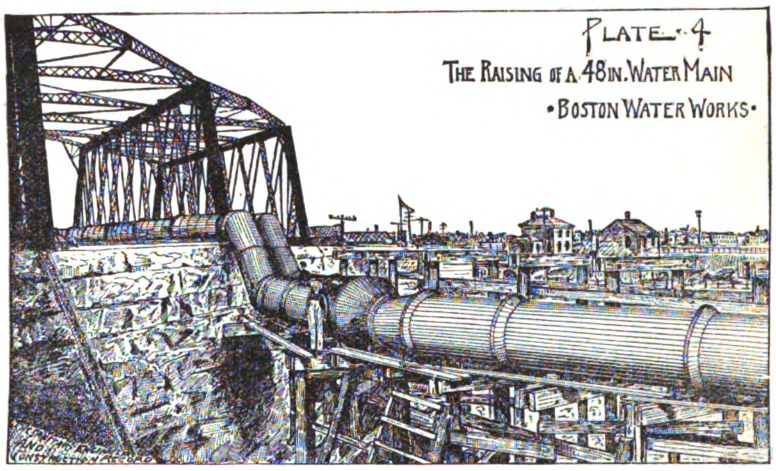


the Boston and Albany Railroad at short distance from their junction, and that each of these streets contains one of the large supply-mains of the city. In order to avoid the great danger to the public due to the existence of these grade crossings, over which there was a large travel, it was decided to raise the grade of the streets and carry them over the railroad. It was not deemed advisable to leave the pipes at their original grade, and they were raised in the following manner.

The raising of both pipes was done in a similar manner, but the description refers particularly to the larger of the two, the 48-inch main in Beacon Street, which was raised

Plate 4

The Raising of a 48 in. Water Main. Boston Water Works.



for 1,850 feet of its length, supported by a pile trestle, and used while the filling of the street was being done. At the bridge the pipe was raised 18 feet, this amount diminishing to zero at 900 feet either side.

The views and sections show the details of the work.

The bridge was first built, the water-main being inclosed in the masonry of the bridge abutments. Piles, whose tops reached the new grade of the street, were then driven on each side of the pipe at intervals of 12 feet, with intermediate piles at a lower grade for the support of the pipe when raised. These were capped at six inches below the raised grade of the street with double-girder caps. The earth was then excavated around and to the bottom of the pipe, and the chains and screws for lifting the pipe placed in position, as shown in Plate 2. The lifting-screws, which were 2½ inches in diameter and eight feet in length, are also shown. These arrangements having been made, the pipe was cut on each side of the railroad bridge, and the entire length from the bridge to the

foot of the grade raised at one operation without breaking the joints.

As soon as the pipe reached its new position the supporting caps for the intermediate piles, which had been previously fitted, were placed and fastened in position, and wedges were then driven between the 12x12-inch caps and the pipe. The pipe was then connected across the bridge, all the joints redriven, and the water turned on. On account of the large number of lifting-screws required but one-half the pipe was raised at a time. The time occupied in raising each section of about 900 feet from its original position to the new grade was about six hours.

The bracing and timbers for the support of the railroad-track, from which the filling of the street was done, were then placed in position and the street filled. In order to avoid communicating the jar, caused by the running of gravel-cars and locomotives over the trestle, to the water-pipe, the wedges between the pipe and the 6x12-inch girder-caps, which were bolted to the piles carrying the railroad-track, were not put in until the filling was raised above the

PLATE 1.

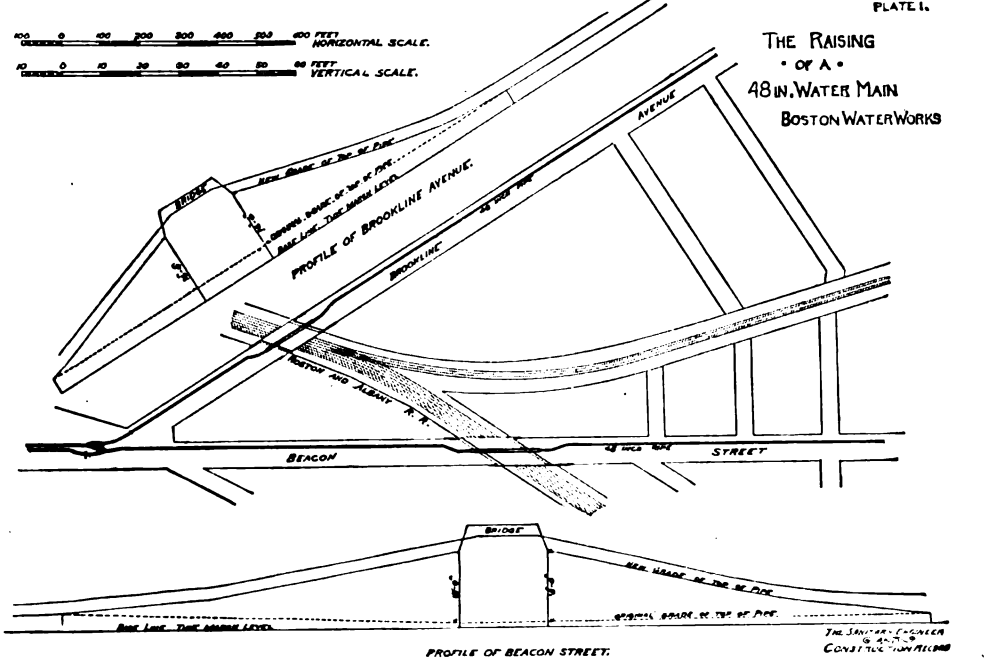
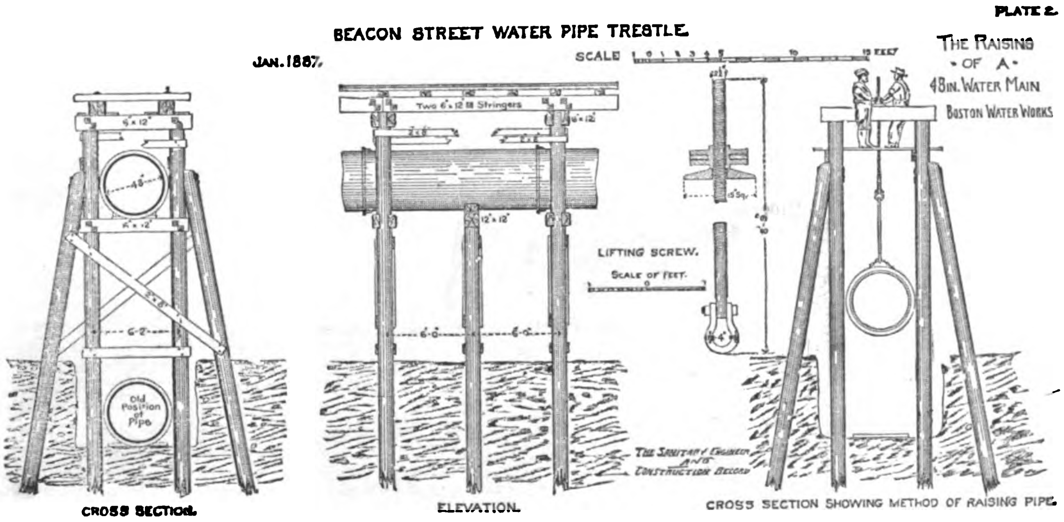


PLATE 2.



top of the caps. The pipe was to this time supported independently from the railroad trestle. The pipe was divided at either side of the railroad, and the water is carried over the bridge in two lines of 36-inch wrought-iron pipe connected by a Y-branch at either end. These wrought-iron pipes and the connections required to connect them with the line of the raised main were placed in position before the pipe was raised. Plates 3 and 4 give some idea of the general appearance of the work.

The trestle was built by F. G. Whitcomb, of Boston, at a cost of $5,168.55. All other work in connection with the raising of the pipe was done by Mr. E. R. Jones, superintendent of the Eastern Division of the water-works. The entire work was done under the direction of William Jackson, Esq., City Engineer, his assistant, Mr. Dexter Brackett, having direct charge of the work.

PAVEMENTS AND STREET RAILROADS.

No. IV.

(Continued from page 589, Vol. XIV.)

FROM the experience of the city of Liverpool we may glean some interesting facts respecting the use of wood for pavements.

In special reports by the engineer, Mr. Clement Dunscombe, it is stated that it would not be prudent to assume a longer life than ten years for wood, under the best conditions, and of the superior class laid down in that city. In streets of minor traffic this may be exceeded, but in those of heavy traffic it will be reduced.

(The life of natural-rock asphalt pavement may be taken as at least twelve years). In one street paved with wood, with a traffic of 94,000 tons per yard of width per annum, the wear was at the rate of ¼-inch per annum. In another street, with 302,000 tons per annum, the wear was 0.58 inches. The wear is found to be greater in the latter years of the life of the wood than in the first years. Mr. Dunscombe estimates the wear within tramway tracks at about one-third more than the remainder of a roadway.

He states that to keep a wood pavement in good condition it should be graveled. "The fibres of the wood ought never to come under direct wear, but the surface should be kept indurated with sharp gravel."

The unequal wear of the blocks between rails of tramways he considers to be a serious drawback to the use of wood in tramway streets. "Properly laid tramways ought not to present the slightest impediment to even the narrowest-wheeled traffic, and in order to maintain them and the track in proper order it is necessary to use materials for paving of the most durable kind—such as the toughest syenite sets—which shall approach most closely in wear to that of steel rails. By such a selection of materials only can the repairs to the pavement due to the unequal wear of sets and rails be kept at a minimum." The life of steel rails in Liverpool tramways is about sixteen to twenty years, whilst the wear of the hardest wood is considerable. When the wood has worn down to the extent of half an inch at or near the rails, it should be relaid—at least that portion adjacent to and between the tracks, as it endangers the wheels of light vehicles if it is not done. This first repair will come where traffic is heavy in about two to four years with wood pavements, and the frequent tearing up of the street for repairs shows the necessity of using a more durable material.

The cost of maintenance of wood pavement is placed at about 45 cents per yard per annum, and of graveling, watering, and scavenging at 22 cents. The cost of maintenance of syenite sets is placed on the contrary at 4 cents, and of watering and scavenging 14 cents per square yard only.

From a paper by Mr. Park Neville, M. Inst. C. E.,* we gather additional information as to foreign practice. It is well known that wood pavements have met with considerable favor abroad, on account of their freedom from noise and greater safety to animals against falling. The number of patents on wood pavement is considerable, eight different ones being described, and among them some of those with which we are familiar, but under different names. The "asphalt wood pavement" seems to be the one most recently adopted. In this a thorough concrete foundation is made and accurately shaped. On this is placed a ½-inch of asphalt mastic, on which creosoted wood blocks are placed, with spaces of half an inch between rows, and the blocks carefully breaking joint in the rows. The lower portion of the spaces for 2 to 2½ inches up is filled with melted asphalt, and the remainder with cement grout with gravel. In London this costs $4 per square yard.

Colonel Haywood, of London, says wood can be kept cleaner than asphalt and at less expense. He estimates the life there at six to nineteen years, or ten years without repairs, but those who have ridden over the Piccadilly will have learned that in less time than this they become anything but a smooth pavement, owing to the unequal wear of the blocks.

Mr. Strachan estimates the cost of scavenging wood at one-sixth that of macadam.

While one-third of a load of mud is being taken on an average from wood pavements, there will be two loads taken from granite and four from macadam.

Mr. O. H. Howard argues that the arch form of a street cannot be relied upon for distributing the pressure, and he, with others, claims that the wood should be considered merely as a surface or veneer; the *sine quâ non* for wood paving is a thoroughly good concrete foundation, and this is the real basis of the pavement. Great stress is laid upon creosoting and upon the use of only hard, tough wood; and one wood pavement on a bridge is mentioned as having outlasted some granite blocks on the same bridge.

In reference to the concrete foundation, Mr. Deacon is quoted as follows: "The ground on which the foundation is to be laid is first well watered; upon this is then scattered a layer of wet broken stones, on which is spread a thin stratum of cement mortar, and then a further layer of broken stones. This last layer is then beaten into the lower layer with beaters like large spades. This is followed by another layer of mortar, and a third of stones, until the required thickness is attained, when the surface is well beaten and finished by rubbing with the beaters to the proper curvature to receive the pavement. The cost of such a foundation is about 94 cents a square yard, and bituminous mastic foundations, six inches thick, cost in Liverpool 88 cents per yard.

Mr. James Newlands consolidated a foundation by excavating eighteen inches, then filling up to the grade needed for placing granite sets upon with old macadam material and allowing the traffic to come upon it several months. The surface was then leveled, an inch of pebbles placed on it, and the sets placed and grouted.

Mr. Neville gives finally his own conclusions:

He is in favor of wood pavement, on the understanding that it has a thoroughly good concrete foundation, but this should be provided for stone or asphalt as well.

Where there is very heavy or very much light traffic at rapid speed, he considers stone blocks "from the igneous, plutonic, and metamorphic rocks or the syenite granites (pure granites are unfit)" as best. These should be thoroughly dressed so as to enable close jointing, and should be laid on a bed of Portland cement concrete mixed six to one with its top surfaced with cement mortar, and allowed to set ten days before the paving is done. It should be protected during this time by tarpaulins from heavy rain or frost. The sets should be wheeled to place on planks so as not to disturb the bed.

The sets he prefers to lay close or with not more than

* A Description of Wood and Asphalt Pavement for Cities and Towns. Read before the Institution of Civil Engineers of Ireland April, 1886.

½-inch joints, which after careful ramming are to be filled with fine pebbles and asphalt. Such work he estimates to cost $3.12 per yard, and the best quality of wood pavement at $2.94.

Asphalt mastic pavements and compressed asphalt he favors except as to slipperiness.

The annual maintenance of wood pavements is given on the authority of Colonel Haywood as costing in London from 18 to 30 cents per yard, of asphalt the same range, and of granite from 6 to 19 cents. The average cost per year, including first cost and maintenance, for wood 40 to 61 cents, for asphalt 33 to 59 cents, and granite 25 to 69 cents per yard.

The broken stone placed annually upon the macadam streets in Birmingham varies from 150 to 450 cubic yards per mile each year. This shows how unfit this class of pavements is for streets used for heavy traffic

(To be continued.)

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

HEATING RAILWAY-CARS.

Various methods of warming railway-cars were discussed by the New England Railroad Club, in Boston, on the 9th inst. The late calamities made heating and lighting a pertinent topic, and nearly 200 gentlemen interested in railroad matters in and about Boston attended.

The Boston *Herald* report of the meeting is as follows: Superintendent Folsom, of the Providence Railroad, asked Mr. Marden to give an account of the peculiar accident some weeks since on the Fitchburg Road, when a number of cars were overturned without setting them on fire.

Mr. Marden detailed the particulars of the accident, and said: "A sleeper and two coaches were turned over, but the heaters in the cars were kept intact."

Mr. Lauder, of the Old Colony Railroad, said that, in view of the recent terrible accident in Vermont, the railroad members of the club, at least, ought to approach the subject of heating cars with the greatest care, and be prepared to throw over their preconceived notions, if necessary. He was still of the opinion that cars have, for years to come, got to be heated individually, and the question is how to do it safely. He was free to admit that trains can be heated by a continuous system from the engine, but there are many difficulties in the way of its general adoption for all roads and all trains. He thought that the hot-water heating system is the only one yet proved to be a success, and one way of making it safe is to enclose the heater in a steel box, which will not let the fire out into the car in case of derailment. The cost, he believes, will not stand in the way of its adoption by any railroad.

President Marden said the tone of the daily press was evidently in favor of steam, and he would like to hear from different gentlemen as to their ideas.

Mr. Adams, master car-builder of the Boston and Albany, was called up, and he said he was still a believer that steam heat is the coming heat. It is true there are some difficulties, but he thought they were not insurmountable. He believed the officers of his road were satisfied they have got to heat their cars with steam from the locomotive for both safety and economy. The success of the Martin heater has been such that they had no general fault to find, and he thought that before the winter had gone another train will be equipped. The train now equipped has not lost a trip, and that cannot be said of a certain other heater, for they are frequently in shop for repairs of pipes. Steam-heating is being put in almost all buildings, and stations at all points can easily be equipped with steam-heating apparatus and a pipe be run from it to heat cars before being attached to the engine. Mr. Adams told about the success in warming the cars in the coldest weather of the past month. He said Mr. Lauder's plan was feasible, but he did not approve of it because he thought steam is the coming heat. He thought that five years hence a good many trains, in New England at least, will be heated with steam, and the time is coming when it will be as universal as the Westinghouse brake.

Mr. Robert Miller, of the Michigan Central Railroad, was called upon to suggest what difficulties his road would find should steam heat be adopted. He said he thought steam-heat apparatus would have to be put in at terminal stations to heat the cars before they started out. In case the train was snowbound and the engine fire gone out he thought a supplementary heater in the cars would have to be provided. He thought perhaps there is as much danger from lighting as from heating, and both should be guarded against.

Mr. J. T. Woodward, of Portland, was invited to explain the Sewall heater. He began by saying that the present style of cars is really as perfect a man-trap in case of collision as could well be devised. The passengers sit with their feet under the seats, which slide together in case of collision, pinning them down, and, the heaters breaking, let their fire out among the upholstery, thoroughly dried, and thus prepared for rapid combustion. He then in general terms described the Sewall heater, which is a system of steam-heating from the engine, being tried upon the Maine Central.

Mr. Sewall, the inventor of the heater, followed by describing its mechanical construction. Steam is taken from the engine, both exhaust and direct, through a peculiar patent coupling in the centre of the car. The piping is along the side of the car instead of having convolutions of pipes under the seats. In the aisle of the car is a simple valve for turning on the heat. Steam is taken at a very low pressure, and the cars are kept at a temperature of 70° or more. A hot-water well under the car is provided for superfluous water, and a provision is made for heating it by a grate beneath. [Mr. Sewall exhibited a coupling, which was generally admired by those present on account of its simplicity.] Cars equipped with the Sewall heater would not couple with the Martin system, but if the coupling was the same the two systems could be run together. Mr. Sewall stated that the heater had been in operation since 1880, though he had been at work perfecting it from that time to the present. The pipes used are 1¼ or 1½ inch, three of which are on each side of the car.

In reply to a question, Mr. R. H. Blackall, superintendent of the motive power on the Delaware and Hudson Canal Company, said he couldn't say what difficulties would be found on his road in taking steam from the engine.

Mr. Griggs, of the Providence and Worcester, said he could see no objections to heating his cars with steam from the engine, though if his road connected with other roads he should want to know if the other road was to put it on before he did.

Hon. Robert Johnson, inventor of the Johnson heater, read recommendations showing that his heater furnishes abundant heat in the coldest weather. He said that, as regards safety, his heaters have been in several accidents and the fire has been immediately extinguished.

Mr. R. B. Owen, of Detroit, explained the manner in which the Smith & Owen Heater Company guards its heaters from all danger of setting the cars on fire. The heater consists of a steel boiler, ¼-inch thick, surrounded by a water-space 1¼-inch thick; the boiler is bolted firmly to the floor; the doors to the fire-box and the ash-box are protected by a sliding steel sheet securely fastened. The steel boiler is as strong as any locomotive boiler, and would not be broken by collision.

Mr. Adams said it was evident from what had been presented that steam-heating is practicable, and he was more firmly convinced than he ever was before that steam is the coming heat.

Mr. Gold, whose system of steam-heating is in use on the elevated railroads of New York, was called up. He said his system is substantially the same as those described by others, except in the method of storing the heat. He uses two pipes, one within the other; the outer one is four inches in diameter and the inner 3½ inches. The inner pipe is filled with hot water, which is heated by the steam at the same time the car is heated. The car can be kept heated from five to seven hours after being detached.

Mr. Lauder called attention to the fact that any heater for Boston roads must be capable of heating at least twelve cars.

Mr. Stone, of the Providence, Warren and Bristol, stated that he had just equipped a train with the Gold system, and at the next meeting would tell how it works. He selected that system because of its capacity for storing heat.

Mr. Peck explained a casing of boiler-iron which had been invented to put over any heater in a car, and which works automatically. He also exhibited a model of the invention.

Mr. Baker, inventor of the Baker heater, described his heater, and claimed that the system of heating with steam from the engine is only suitable for short roads or runs.

The meeting adjourned at 10:30 o'clock.

The March meeting will be devoted to a consideration of "lighting cars in passenger service."

EVAPORATIVE POWER OF COAL.

Requests from readers for fuller information about the tests on the evaporative power of pea, egg, and soft coals, at the Belmont Pumping Station, referred to in a short paragraph in our issue of February 5, induce us to reprint the results from the report of Colonel William Ludlow, Chief Engineer of the Water Department, for 1883.

The tests were made to ascertain the probable results of reducing the size, and perhaps of changing the kind of coal used. While they were not intended to be exact scientific determinations, they were made with such care that the results are of great practical value. They were made under the supervision of Mr. Lloyd Bankson, Assistant Engineer.

COMPARISON OF THE EVAPORATIVE POWER OF PEA, EGG, AND SOFT COAL.

TESTS MADE AT THE BELMONT PUMPING STATION, UNDER THE DIRECTION OF WILLIAM LUDLOW, CHIEF ENGINEER OF THE PHILADELPHIA WATER DEPARTMENT.

Test.	A	B	C	D
Date, 1883-1884.	Nov. 19-21	Dec. 6-8	Dec. 11-13	Jan. 17-21
Variety of coal.	Pea Coal	Egg Coal	Soft Coal	Pea Coal
Price of coal per ton (2,240 lbs)	$2.89	4.38	3.58	2.65
Duration of test in hours.	48	48	48	93
Pounds of coal burned per square foot of grate per hour.	6.6	6.0	6.1	6.8
Pounds of water evaporated per pound of coal—(actual).	8.08	9.04	9.09	7.98
Pounds of water evaporated per pound of coal from and at 212° F.	9.21	10.30	10.36	8.87
Pounds of water evaporated per $1-worth of coal—(actual).	6202.0	6622.9	5726.7	6743.1
Mean boiler pressure.	55	55	55	55
Mean temperature of hot well.	108°	107°	110°	106°
Mean vacuum.	28¾	28¾	28¼	28¼
Mean number of revolutions.	12.9	13.3	13.6	13.5
Mean water pressure.	88	88	88	88
Pounds of coal burned per 24 hours.	24,690	22,535	22,760	25,776
Percentage of ash.	17.3	13.4	8.08	16.6
Gallons pumped per 24 hours.	5,789,940	5,897,736	6,125,652	6,097,968
Pumpage in foot pounds per 100 pounds of coal.	42,323,000	47,232,000	48,559,000	42,698,000
Pumpage in foot pounds per 1c.-worth of coal.	3,280,032	2,415,444	3,059,217	3,609,261
Gallons raised 1 foot high per 1c.-worth of coal.	393,289	289,622	366,812	432,606
Percentage of gallons 1 foot high more than egg coal—dollar for dollar.	35.8	00.0	26.6	49.4
Colliery, character of coal, etc.	Hard Pea, Ellengowen Colliery, Schuylkill Co., Pa.	Hard Egg, Ellengowen Colliery, Schuylkill Co., Pa.	Soft Coal, Colorado Colliery, Clearfield District, Pa.	Dusty Pea Coal, Cameron Colliery, Pa.

These tests were made with No. 2 engine, of which the general dimensions are as follows—viz.:

Diameter of H. P. cylinders .... 29 inches.
" L. P. " .... 51¼ "
" plungers .... 22½ "
Length of stroke .... 4 feet.

And with boilers Nos. 9, 10, 11, and 12, each as follows:

Diameter .... 6 feet.
Length .... 12 "
Grate surface .... 39 square feet.

Total heating surface of shell, tubes, and drums, 1,371 "
Water-space .... 331 cubic feet.
Steam-space .... 111 "

HOT-WATER HEATING OF THE GOVERNMENT BUILDING AT WOODSTOCK.

CINCINNATI, O., February 8, 1887.

SIR: In your issue of the 5th of February, 1887, you vored your readers with the details of a hot-water heating apparatus for the Government Building in Woodstock, N. B. For one, I have been particularly interested in the amount of heating-surface determined for each apartment, and have applied to the same building, as far as I have learned its details from the drawings, my own formulas for finding heating-surfaces, and submit below the results of the estimate in inch pipe:

	Fish.	Chace.
Post-Office	1800	1344
Hall	108	174
Passage	120	72
Toilette	100	135
Inland Revenue	150	195
Weights and Measures	150	144
Savings Bank	210	195
Collection of Customs	225	237
Customs (1)	200	270
Customs (2)	240	306
Back room	150	138
Hall	180	57

The formulas used by myself in the above estimates are based upon the probable losses of heat in three ways:

1. The loss of heat by air escaping from the rooms.
2. The loss of heat by radiation, etc., from glass.
3. The storage (or loss) of heat in the walls of the apartments.

In the general formulas,

L = the length of the room;
W = the width of the room;
H = the height of the room;
w = the width of a window;
h = the height of a window;
T = inside temperature;
t = outside temperature.

H W L would be the cubic contents of a room, which, multiplied by 1.4, would give the loss of heat in units per hour if the air in the room at 70° Fah. was renewed once each hour; $w\ h$ multiplied by the number of windows would give the square feet of glass, which, multiplied by 130, gives the loss of heat by glass and leakage additional to that above mentioned.

Then $2\left(L + W + \frac{L\ W}{H}\right) H$ gives the entire interior surface of the room, floor, walls, and ceiling. This is to be multiplied by 6 in well-built rooms exposed on all sides, and by ½ in rooms having no outside exposure.

The factor 6 may be increased to meet extreme cases.

So, too, in the case of the first formula the number 1.4 will be affected by the value of $T-t$, and the construction of the building exposure is an element not considered at present.

Suppose the Post-Office to be such that $L = 52.5'$, $W = 34.7'$, and $H = 15'$. Also that $w = 7.2'$, $h = 7'$.

The procedure would then be as follows:

POST-OFFICE.

$$52.5 \times 34.7 \times 15 \times 1.4 \ldots\ldots 38{,}266$$
$$5 \times 7.2 \times 7 \times 130 \ldots\ldots 32{,}760$$
$$\left(52.5 + 34.7 + \frac{52.5 \times 34.7}{15}\right) 15 \times 2 \times 3 \ldots\ldots 35{,}302$$
$$106{,}328$$

The last number shows the units of heat needed per hour to warm the room to 70° Fah. in zero weather.

The amount of radiating surface needed to give off this heat will vary nearly inversely as the temperatures of this surface. In this job Chace assumed that each foot of surface would give off 237 units of heat per hour, and 106,328 divided by 237 gives 448 as the surface needed.

This method was followed in all the rooms except the passage and the hall on the first floor, but as the pipes in those rooms were freely exposed the divisor was 270. The results have been already given.

The discrepancies in the two estimates merit a passing notice. Fish's estimate for the Post-Office is very nearly 34 per cent. higher than Chace's, while Chace's estimate is 70 per cent. higher for the hall than Fish's, notwithstanding the outside door and side-lights. In the passage which has but little exposure Fish has 66 per cent. more surface than Chace. But what seems remarkable is that Fish has 20 per cent. more surface in the passage than in the toilette, which has two windows and two sides exposed. This may be accounted for by the low temperature called for in the toilette-room.

The hall on the second floor has 57 feet by Chace's estimate, and 180 by Fish's, and the room has no outside exposure whatever. The whole amount of heat required in Chace's estimate is 338,749 units, which represents 350 pounds of water evaporated from 212 degrees in one hour.

The amount of coal per hour, assuming nine pounds of water per pound of coal, is 38.9 pounds per hour. This is as much as it is advisable to burn on a grate suitable for a 36"x8' boiler.

The arguments for the various assumptions in the above estimate are not given, supposing that they might not be interesting, and that if they were interesting they would be called for. C. B. CHACE.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. V.

(Continued from page 265.)

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

COLD-WATER SUPPLY-PIPES.

1. What size should the pipe from the street-main to the house be?

Should be as large as possible, according to amount of pressure and size of building.

2. What material is used for this pipe in New York?

Generally lead pipe?

3. What other materials besides lead are used for supply-pipe?

Galvanized iron, balck iron, tin-lined lead pipe, brass, and occasionally cast-iron pipe.

4. How is iron used?

Galvanized and black—sometimes lined with block-tin or glass.

5. What are the advantages and disadvantages of lead pipe?

Advantages—Pliability, strength, and durability.

Disadvantages—Danger of poisoning and of corrosion.

6. What are the advantages and disadvantages of plain iron pipe?

Advantages—Cheapness, ease of putting together, and safety from poisoning.

Disadvantages—Want of durability, owing to rust eating holes in it, and of filling it up.

7. What are the advantages and disadvantages of tin-lined pipe?

But little used. Difficulty of preventing water from getting between lining and pipe.

8. What are the advantages and disadvantages of glass-lined pipe?

An excellent pipe in many respects, but liable to have lining broken from bending and from frost.

9. What are the advantages and disadvantages of galvanized-iron pipe?

Advantages—Cheapness and freedom from rust, durability, etc.

Disadvantages—Some waters decompose zinc, and the salts are poisonous.

10. What are the advantages and disadvantages of brass pipe?

When well tinned it is light, strong, and durable; objection is that it is supposed to be poisonous when not tinned.

11. What are the advantages and disadvantages of block-tin pipes?

Perfectly safe; but expensive and difficult to work. Hot water affects its durability seriously.

12. What are the advantages and disadvantages of tin-lined lead pipe?

It is a safe and durable pipe for cold water. Hot water produces an unequal expansion in the two metals and soon destroys it. Lime also affects the tin.

13. In using tin-lined pipe what must be guarded against?

The lining should be carefully preserved in making the joints, either by using the proper kind of solder, or using tinned-brass ferrules.

14. How should the supply-pipe be connected with the street-mains?

By the usual corporation tap and brass union.

15. How should a lead pipe be joined to an iron pipe?

Either by a soldering-nipple or brass ferrule.

16. Should the supply-pipe be so arranged that it can be emptied, and why?

Should descend gradually to the lowest point where it can be emptied, so as to prevent danger of freezing or water becoming stagnant.

17. What precaution can be taken against freezing if the main is within three feet of surface?

By dropping pipe to proper depth below the main and protecting the more exposed parts.

18. In crossing an area with a supply-pipe, what precaution should be taken?

By covering with felt or mineral wool, or placing it in a box filled with charcoal or sawdust.

THE PHILADELPHIA TRADE-SCHOOL.

(From Our Special Correspondent.)

THE Trade-School of the Master Plumbers' Association of the city was opened for the three-months' term agreed on by the Board of Directors, February 1, in the rooms of the school connected with the association quarters. The number of scholars, owing to several causes, was smaller than expected; but much interest is felt in the school by the apprentices, and in a short time there will be an attendance equal to that of last season. The intention of the board is to devote two nights each week to the school, Tuesdays and Fridays, the former of which might well be devoted to instruction to shop practice and such points in the mechanical parts of the business as apprentices are not likely to come into contact with in regular shop practice. The sessions on Friday evenings will be devoted to instruction in a newly introduced branch of the trade—namely, free-hand and mechanical drawing, with especial attention paid to drawing of plans. The first session was held on Friday, the 4th inst., and some eighteen were present to receive instruction from Mr. Thomas Chase, a teacher of drawing and a graduate of Spring Garden Institute. It is expected that this class will not be composed alone of boys, but that quite a number of the masters have expressed a desire to become more proficient in this branch and will become members of this class. Any master who is a member of the association, or any apprentice to any member, may become a scholar in the school by the payment of the fee of $3.

MAKING A CELLAR DAMP-PROOF.

YONKERS, January 21, 1887.

SIR: Will you please illustrate a plan of making a cellar of a house damp-proof—*i. e.*, so water can be excluded—that is situated so that under the house there are several springs? The bottom of the cellar has been concreted to a depth of two feet, still the water comes in.

H. D. L.

[The first thing to be done in such a case is to provide some chance for the water to run away before getting into the cellar. The writer has built a good many houses in wet places, where the water would have given trouble if such precautions had not been taken. The method of proceeding is to have a 2-inch tile drain-pipe laid in a trench dug all around the foundation outside of the walls, and from one foot to two feet below the cellar floor. Put this pipe together without mortar, and cover it with cobble-stones to keep out the dirt and sand. If the house lot is not large enough or sloping enough to give an outlet for this drain on the surface of the ground, it must be connected with the public sewers with such precautions as have been described in THE SANITARY ENGINEER AND CONSTRUCTION RECORD, pp. 234 and 286, Vol. IV.

If, after laying such a drain, water comes through the side walls of a cellar, it is because the material with which they were back-filled was not porous enough to allow the water to go directly downward into the drain. Such a material should always be provided.

In case of houses already constructed without proper ground-drainage, and where the digging down outside below the foundations might endanger the stability of the walls or incur an unreasonable cost, a drain may be laid directly inside the walls by digging down in the cellar bottom all around. But the remedy is not so thorough and sure as if the drain were outside, where it properly belongs, especially where water comes through the body of the walls above the cellar floors.

Cases may occur where no outlet for a cellar-drain can be found on the house lot and where no sewers are provided. We can only say that if the soil is not porous in such cases, and if on this account water gets into the cellar, then the locality is not fit to build a house on till either a sewer is provided or a special drain leading to some point low enough to insure its efficiency at all times.]

AGREEMENT BETWEEN PLUMBERS AND THE CITY OF BIRMINGHAM, ENG.

WE give here the form of agreement which the corporation of Birmingham requires plumbers to enter into, as a condition requisite to doing work on water-piping or fixtures:

AGREEMENT made the........day of....... 188.., between the Mayor, Aldermen, and Burgesses of the Borough of Birmingham (hereinafter called "the said corporation"), by........the Engineer of their Water Department, of the one part, and..... ..of Birmingham........of the other part.

The said corporation appoint the said........and he agrees to act as an authorized Plumber to the Corporation, to do all work in connection with Water Service-Fittings, in accordance with the Rules and Regulations of the Corporation, and in conformity with the directions that may be given from time to time by the Engineer to the Corporation Water Department.

The said........shall also undertake any repairs in connection with the Water Service-Fittings that he may be directed to do by any of the customers of the Water Department who have insured their Water Service-Fittings, and shall do all such work in a good and workmanlike manner, and with all reasonable speed. He shall also faithfully observe all the regulations from time to time in force of the Water Department of the said Corporation.

The said........shall, within two days after doing any work, report the same to the Engineer of the said Water Department, by forwarding priced invoice for work so done.

The said....... shall also, with all reasonable speed, inform the said Engineer of all alterations in, and additions to, the Water-Fittings of any of the consumers of water which shall come to his knowledge, whether such alterations shall have been made by him or otherwise.

The said........will not employ, on any work done in pursuance of this Agreement, any person whomsoever who is not authorized by the Department either as a master Plumber or an operative Plumber.

For all work done under this Agreement, the said Corporation shall pay to the said. ......remuneration after the Scale of Charges hereto annexed, being the same scale as charged by the Corporation for work done by them.

It shall be lawful for the said........to make alterations and extensions to the Water-Apparatus of any consumer, without having, in every such case, to obtain the prior consent of the Water Department of the Corporation.

This Agreement may be determined by the said Corporation, by notice in writing, immediately on a breach of any of its clauses by the said........ It may also be determined, by either party, by one week's notice in writing. As witness the hands of the said parties.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

PERMANENT MONUMENTS.

OSWEGO, February 11, 1887.

SIR: In your issue of February 5 is described the system of permanent monuments adopted for fixing the New Aqueduct alignment. My experience with similar permanent line-marks may be of interest.

At several different times since 1870 I have used cut-stone monuments to mark the corners of United States reservations and to preserve valuable base lines.

The monuments have been roughly dressed stone shafts, five feet long, sixteen inches square at base, tapering toward the top, and with the upper foot dressed to eight inches square, the whole set in a pit three feet square and 4½ feet deep, the space around the monument being filled with small stones, gravel, and earth solidly packed in thin layers, the top of each stone marked with its diagonals and set six inches above ground, with inscription cut on the sides.

In the first two cases a hole was drilled in the centre of the top of each stone, and in each was bedded in sulphur a copper bolt five-eighths of an inch in diameter and six inches long, split and wedged at its base to prevent its withdrawal. This is essentially the same as the proposed aqueduct monuments.

In both these cases the arrangement was found to withstand all the forces of nature, except the ubiquitous small boy, who is as omnipresent and as necessary to be considered as is the heat of summer or the frost of winter, and to whose abundant leisure the ten ounces of copper in each bolt proved a sufficient inducement for the destruction of the monuments; small granite boulders being the primitive tools used to break the stones.

Since finding these monuments broken, I have, in similar cases, omitted the copper bolts, and have used tapering stone shafts, dressed square for their whole length, and accurately set so that the vertical axis marks the desired point. If the top should be broken off, drawing the diagonals on the remainder will give the corner.

To mark a point in bed-rock the only need is to fill the drill-hole in such a way that it can be identified. This can readily be done by running the hole full of hot asphaltum, and marking the exact point, if desirable, by a copper wire of one-tenth of an inch diameter set in the soft filling.

It may be that the boys of Westchester County will prove less destructive than those whom I have encountered, but, as the value and the attractive power of the copper bolts described for the aqueduct marks are more than twice as great as were mine, special precautions, if not special police, will be needed to insure their permanence.

WILLIAM PIERSON JUDSON,
Mem. Am. Soc. C. E.

DIX ISLAND QUARANTINE HOSPITAL.

BOSTON, MASS, February 5, 1887.

SIR: Answers to the following questions would greatly oblige a subscriber, and would probably be of some interest to other readers: Have you ever published the plans of the Dix Island Quarantine Hospital, near New York City? What publication contains the most detailed description, with plans of those buildings? What was the approximate cost of the various buildings? Have any valuable improvements been made or suggested?

Very truly yours, E. P. ADAMS.

[We have never published the plans of the Dix Island Hospital, and are unable to give our correspondent the cost. Our correspondent can probably obtain the information he wishes from Dr. William M. Smith, Health Officer of the Port of New York.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
February 12...	25.14	20.24	21.55	29.27	29.11	21.03	32.73

E. G. LOVE, Ph.D., *Gas Examiner.*

THE GAS QUESTION IN BROOKLYN.

THERE is a strong probability that before long Brooklyn will have cheaper gas. The bill introduced by Mr. Griswold fixed the price of gas in Brooklyn at $1 50 per 1,000 feet. After listening to arguments for and against this bill the Senate Committee on Cities reported it with the price fixed at $1.60 instead of $1.50.

The hearing before the Cities Committee has brought out more information relative to the working of the Brooklyn companies than the public have ever had before. These facts were contained in the argument of Mr. E. B. Thomas, who appeared for the gas companies. Brooklyn has seven gas companies, or one company to 100,000 population. The total capital stock issued by these companies amounts to $9,169,900, to which must be added an indebtedness of $2,792,236. The total quantity of gas sold in 1886 was 1,310,130,085 cubic feet, which was distributed through 460 miles of mains. The number of consumers per mile of main ranges from 68 to 124, with an average of about 95.

The average dividends paid by the companies for the past ten years ranges from 1.8 per cent. in the case of the People's Company, to 7.9 per cent. for the Brooklyn Company, the average of all being 6.1 per cent.

The total amount of taxes paid by the seven companies is $209,355, or about 16 cents per 1,000 feet of gas sold.

The present price of gas in Brooklyn is $2 per 1,000 feet, and the principal point of Mr. Thomas' argument was to show that if the price is reduced to $1.50 some of the companies will be ruined. The three companies most likely to succumb are said to be the Citizens', the People's, and the Metropolitan. These companies, ever since the "freezing out" operations of the Fulton Municipal Company, and the subsequent division of territory, have bought their supply of gas from the latter company at 75 cents per 1,000 feet in their holders. It would be interesting to know how 1,000 feet of water-gas in the holder can be made to cost 75 cents, even allowing a liberal profit to the manufacturer.

Mr. H. D. Hotchkiss, who appeared in support of the Griswold bill, stated that the three companies who are contemplating ruin each paid six per cent. dividends in 1886.

The people of Brooklyn are suffering the consequences of having permitted the establishment of more companies than were needed, in the vain hope that new companies would keep up competition and keep down the price of gas. It is the old story, one company after another, until now Brooklyn has more gas companies than she can support, and when the Legislature is called upon to furnish relief the companies complain and urge that the consumers owe them a living.

The Brooklyn companies are willing to leave the question of price to a gas commission, the appointment of which is provided for by a bill already before the Legislature. We understand that this bill gives the proposed commission authority to fix the price of gas, but at the same time allows the companies to declare dividends up to ten per cent. The price of gas in New York, however, will remain at $1.25, as fixed by the Legislature last winter, and unless the price of gas in Brooklyn is fixed in a similar way there seems to be no reason why a commission would not be obliged to restore the old rates so long as the companies were not earning ten per cent. dividends.

THE New York State Senate has passed the bill fixing the price of gas in Brooklyn at $1.60 per 1,000 cubic feet.

IN the month of January there were exported from the United States, of petroleum and petroleum products, the following quantities: Of crude mineral oil, 8,097,185 gallons, valued at $519,757; of naphthas, 975,730 gallons, at $88,932; of illuminating oil, 37,075,349 gallons, at $2,925,615; of lubricating and paraffine oils, 1,284,621 gallons, at $219,333; of residuum, 120,666 gallons at $5,600; totals, 47,535,551 gallons and $3,759,237, compared with 42,017,944 gallons and $3,687,089 for January, 1886.

THE United States Senate has passed the bill providing that the Washington, D. C., Gas-Light Company shall charge for gas $1 per 1,000 cubic feet.

SALT LAKE CITY in March, 1872, made a contract with the gas company to supply gas for street and public lighting for 21 years. Recently there has been an agitation to get lower rates than the company was giving, and an agreement has been reached with the company by which the price per lamp per annum, from January 1, 1887, to December 31, 1889, is to be $35, and from January 1, 1890, to March 8, 1893, $33. City buildings are to be lighted at $2.50 per 1,000 cubic feet. In 1872 the price for street-lighting was $65 per light per annum.

THE London *Times* contained an article recently on the coal industry of the United Kingdom. Referring to the article, the *Journal of Gas-Lighting* says: "It is believed that the total production of coal for 1886 in the whole country will show a decrease as compared with 1885; which, in turn, was lower than the preceding year. Meanwhile other countries have greatly increased their coal production; and although all of them, with the exception of the United States, are still dependent in a great measure upon British coal for all purposes for which the highest class of fuel is required, they are doing their best to supply their own wants in other directions. The only coal yet discovered that can compare on equal terms with the best British product is that of Pennsylvania. It appears, moreover, that circumstances are generally favorable to the American article; so that the miners can turn out from 400 to 450 tons per man per annum, while in the United Kingdom the yearly output is only about 350 tons per head. The average value of best Pennsylvanian anthracite at the pit's mouth is rather less than the British average. During the past decade the coal production of the United Kingdom has increased by 27,490,000 tons, while that of the United States has been increased nearly twice as much, and Germany has also a greater proportionate growth. Thus the assumed geometrical rate of progression of output which the late Professor Stanley Jevons took to be the inevitable cause of the early exhaustion of the British coal-fields has not been maintained. Such increase as there is has been chiefly in connection with the extended working of South Wales and Midland deposits; the Cheshire, South Staffordshire, Shropshire, and West of Scotland trade having actually diminished.

THE Standard Gas-Light Co. of this city has adopted a new system for the distribution of the gas they propose to manufacture. The company commenced by laying a 4-inch wrought-iron main, but later the size was increased in some cases to 6-inch and 8-inch. The plan is to distribute the gas under a much heavier pressure than is usually done.

THE ATLAS OF NEW JERSEY.

"THE Atlas of New Jersey," by Prof. G. H. Cook, State Geologist, is rapidly approaching completion, all but four of the seventeen maps required for the entire State being now issued. The accuracy and finish of the work are manifest from even a casual inspection, and its value will increase more and more as the population becomes more dense.

The facilities it furnishes through its accurate topography for railroad work, or determining at once the main features in any scheme of drainage, are alone worth many times the cost of the work. It is of equal value, also, in the planning of water-works or common roads, and can be studied with advantage even by bicyclers and tourists.

It is to be hoped that the time is not far distant when every State shall find it to its advantage to have a similar work performed, and New Jersey deserves great credit for being the first to recognize its economic value and to put it in execution.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met February 2, at Washington University, Vice-President Holman in the chair. The Executive Committee reported the proceedings of its meeting of February 2, recommending Arthur J. Frith, Charles H. Ledlie, and Edward K. Woodward for election to membership. On being balloted for they were elected members. The following applications for membership were announced and referred to the Executive Committee: Horace B. Gale, indorsed by William B. Potter and J. B. Johnson; Otto Schmitz, indorsed by William Bouton and C. H. Sharman; Arthur Thacher, indorsed by William B. Potter and H. A. Wheeler. The resignation of R. S. Hayes, on account of removal from the city, was read.

Mr. J. A. Seddon then read a paper on "Efficiency of Cable Roads, its variation with length of cable, and other elements of the construction." Mr. Seddon called attention to the lack of reliable data on the subject and the difficulty of ascertaining results reached by roads now in operation. The paper gave a thorough analytical and practical discussion of the subject, and was of decided value. Mr. Seddon gave some results of recent tests on the St. Louis cable road, but stated that the trials were not yet complete. The paper was discussed by Messrs. Johnson, Nipher, Adams, Bruner, and Bryan. The hour being late Dr. Adams' paper on "Dynamo Electric Machinery" was made the special order for the next meeting, February 16. Professor Nipher exhibited a piece of apparatus he had devised for determining losses in the magnetic fields of dynamos.

AT the meeting of the Cleveland, O., Civil Engineers' Club, February 8, the following list of officers was put in nomination, to be balloted for at the next meeting: For President, Messrs. John Whitelaw, Ambrose Swasey; for Vice-President, W. H. Searles, W. R. Warner; for Recording Secretary, C. M. Barber, James Ritchie; for Corresponding Secretary, C. O. Arey, Alexander E. Brown; for Treasurer, S. J. Baker, W. P. Rice; for Member Board of Managers of Associated Engineers' Society, M. G. Rawson, M. W. Kingsley. Mr. W. W. Christian, of Norwalk, read a paper on the piping of natural-gas long distances.

THE Kentucky State Association of Architects organized at Louisville, February 11, with the election of the following officers: President, H. P. McDonald; First Vice-President, Henry Walters; Second Vice-President, Mason Maury; Secretary and Treasurer, O. C. Wehle. These officers and Mr. C. G. Clark constitute the Board of Directors.

AT the meeting of the Texas Engineers February 1, in San Antonio, the sanitary condition of the city was discussed.

THE Contractors and Builders of Hamilton, Ont., had their first annual supper January 31, John Webb, President of the association, at the head of the table.

THE St. Paul Builders' Association has voted unanimously to become a member of the National Association, and to send delegates to the meeting of the national body in Chicago next March.

PERSONAL.

EDWARD HEFFNER, contractor for the construction of the Lake Clifton Reservoir of Baltimore's water-supply, died in Baltimore February 4, in his 43d year.

CAPTAIN A. W. GREELEY, of the Lady Franklin Bay Arctic Expedition, has been nominated by the President to be Chief of the Signal Service Bureau, filling the vacancy left by the death of General Hazen.

E. B. A. Hayes, an architect of this city, died in Bellevue Hospital last Sunday from injuries received in a building on Broome Street which he was altering. He was in some way unknown caught and crushed under an elevator.

MR. JOSEPH G. PATTERSON has been appointed by Governor Beaver, of Pennsylvania, Health Officer of Philadelphia. He is a commission merchant, who has been a member of the Board of Health for thirteen years.

CAPTAIN B. W. DOYLE, formerly with the New York, West Shore and Buffalo Railroad, has been elected Secretary of the Pennsylvania Lead Company, of Pittsburg.

ERRATUM.

IN our issue of January 29, the address of Mr. C. F. Schweinfurth, President-elect of the Ohio Association of Architects, should have been given as Cleveland, not Dayton.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 13. PUBLISHED EVERY SATURDAY. NEW YORK, FEBRUARY 26, 1887. LONDON, MARCH 12, 1887. SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA. SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5: South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

THE FAN-TODS.

PROBABLY the majority of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD have a more or less vague idea of what is meant by saying that a certain person "has the fan-tods," but none of them, we are sure, obtained their information about it from books. It is one of those words or phrases in popular use, handed down from generation to generation by word of mouth, and while we have occasionally met with it in print, the only author whom we can at this moment quote as using it is the well-known scientist. Mark Twain.

Nevertheless it is a good word, a most excellent word, and, with its derivatives, fan-toddism, fan-toddic, etc., meets a need which bids fair to become greater as civilization progresses. The nearest scientific equivalent to the "fan-tods" is hysteria, but this cannot take its place. The fan-tods may be scientifically defined as a functional neurosis characterized by excessive emotionalism, great volubility of speech, the feigning to be affected with deep emotion or excitement, and a strong desire for public sympathy and applause. When the nervous system is so deeply affected as to produce spasms of alternate laughter and weeping, with a tendency to convulsive action of various muscles, it is hysteria, or, in popular language, the "high fan-tods." Fan-toddism, in its milder forms, is very apt to affect young journalists, and some good specimens of the results which it produces may be found in the writings of zealous amateur sanitary reformers. The mental effects produced by the fan-tods on the patient are not unpleasant; on the contrary, the feelings of exhilaration due to a sense of superior knowledge and philanthropy which accompanies them is so agreeable as to tempt men to try to produce them artificially. One of the easist ways to do this is to write a paper on some abuse or suffering, with regard to which one knows little more than the fact that it exists, or is said to exist, and for which one has no very definite remedy to propose. As the theoretical reformer reflects on the troubles of A and B, and how C and D ought to be compelled to do something to relieve them, and in fancy sees himself in an office issuing the necessary orders to make everybody clean, comfortable, and happy, he can for a little time forget that he has not been able to manage his own business affairs with any remarkable success. A favorite device of the fan-toddic exhorter is to get up a "scare" by depicting in glowing language the terrible consequences which threaten if his advice is not carried out. From the old-fashioned revivalist, describing the sinner "hair-hung and breeze-shaken" over the flaming bottomless pit, to the orator almost foaming at the mouth as he describes the habitations of the poor, and demands that they shall be strictly regulated by a paternal government to prevent small-pox, scarlet fever, etc., the methods are much the same—viz., appeals to the selfish fears and to the emotions and passions of his hearers rather than to their reason and common sense.

The distinction between genuine spontaneous emotion and the fan-tods consists largely in the element of artificial stimulation, or of simulation, which enters into the latter, or in what may be called the histrionic element. It was understood by the ancients who figured the lion as having a hook in his tail with which he lashed himself into a rage. Such artificial stimulus is at times useful, but it is also at times dangerous. Among the English-speaking race in modern times it rarely produces serious danger to the peace of the community, although the possibility of such danger is not to be overlooked. The chief risk is to the person indulging in it, for he is continually tempted to force it a little further, until he becomes a regular emotional drunkard in the use of superlative adjectives and denunciatory phrases, and as a result loses the confidence of the steady-going, common-sense people, who constitute the great mass of our population, and who are slow to move until their reason, as well as their feelings, is convinced that it is necessary to do so.

It must be confessed, however, that a little fan-toddism gives a spice to life as well as to journalism, and that probably upon the whole it does more good than harm.

REPORT OF THE GAS COMMISSIONERS OF MASSACHUSETTS.

THE Gas Commissioners of Massachusetts have issued their second annual report in the form of a pamphlet of some eighty pages.

Though the powers of this commission are quite limited, yet their being able to secure and publish information about a business that has, unfortunately for itself and the public, been hitherto inaccessible, is an important step in the right direction.

On the 30th of June last there were 63 gas companies in active operation in the State, with an aggregate capital of $12,192,150. The Boston Gas-Light Company, which is the oldest one in the State, was organized in 1823, and to-day has a capital of $2,500,000. Next in the list comes the company in Cambridge, with a capital of $700,000. Twenty-three companies manufacture under the General Law of the State, and thirty-nine under special acts.

The larger part of the stock, or $10,757,737, is held in the State. The following statement, condensed from the report, shows the number of shares and their total value, held by males, females, etc.:

	No. of Shares.	Value.
Held by Males	66,878	$6,404,987
" Females	28,439	2,886,800
" Trustees	15,783	1,962,400
" Executors, etc.	4,676	541,362
" Institutions, etc	3,776	354,800

"The capitalization of the companies making coal-gas varies from $2,948 to $25,000 per mile of main, from $2.19 to $24.78 per thousand feet of gas sold, and from $22.56 to $150 per ton of coal carbonized.

"The companies making oil-gas show a capitalization varying from $1,179 to $9,202 per mile of main, and from $1.59 to $36.31 per thousand feet of gas sold."

A statement of the aggregate receipts of sixty-three companies shows that the quantity of gas sold by meter was 2,091,210,980 cubic feet. The quantity of gas supplied to public lamps and that sold under contract, both of which were estimated, raises the total to 2,349,379,275 feet, the revenue from which was $4,037,723. The sum of $341,020 was received for residual products.

The valuation of all the gas-works as assessed for local taxation was $12,189,768.

One of the tables in the report shows the dividends paid by the different companies. Ten

companies declared no dividend whatever; but most of them were more fortunate, the rate varying from 2½ to 36 per cent. Twenty companies paid dividends of ten per cent. or over, and thirty-one companies dividends ranging from five to ten per cent.

"The average price paid by consumers throughout the Commonwealth was, for coal-gas, $1.72½; for oil-gas, $4.41 per thousand feet."

The percentage of unaccounted-for gas varies from 4.31 to 37.30, that of the Boston Gas-Light Company being 6.38.

The Boston company carbonized 100,755 tons of coal, while for enriching material there were used 781 tons of cannel, 675,802 gallons of naphtha, and 20,396 gallons of "gas-oil."

About 1,134 miles of gas-mains have been laid by the different companies, and the total number of meters in use on June 30 was 84,479.

Of the public lamps, 19,802 are supplied by the coal-gas companies, and 281 by the oil-gas companies. The sulphur limit is fixed at 20 grains per 100 cubic feet, and the ammonia limit at 10 grains. Even with this very liberal standard for ammonia the limit was exceeded by several companies. One company is reported as having supplied gas which contained on one inspection 58.7 grains of ammonia in 100 cubic feet.

The report closes with some twenty pages of "general instructions" regarding the books and accounts to be kept by the companies, and the form of returns to be made to the commissioners.

The American Society of Mechanical Engineers about two years ago appointed a committee to report upon the practicability, and, if possible, secure the adoption of a uniform standard of pipe-threads. The reports of the progress of this committee have been fully noticed in The Sanitary Engineer and Construction Record from time to time. The satisfactory results that followed their labors and the great importance of the matter undertaken justifies, however, our giving space to printing practically entire a record of this committee's work, in order that it may be accessible, and we, for like reasons, present again Mr. Briggs' formula—the one adopted. In the discussion it has been suggested with propriety that correspondence should now be held with committees of engineering societies abroad, with a view of securing the universal adoption of this standard thread. Such results, we believe, would be to the advantage of the engineering and commercial interests in each country.

The Report of the Gas Committee of the Leeds Corporation for the year 1885–6 gives the total quantity of gas sold as 1,679,278,700 cubic feet—an increase of 5.18 per cent. over the previous year. The coal carbonized amounted to 201,332 tons. The leakage was 11.18 per cent. At the close of the year there were 77,000 meters in use, and the number of public lamps was 7,902. The Committee have introduced a number of high-candle-power lamps, 192 in all, varying from 40 to 200 candles each.

A RESIDENCE AT LAFAYETTE, N. J.—J. D. HUNTER, JR., ARCHITECT.

OUR BRITISH CORRESPONDENCE.

The Successor of Col. Sir Francis Bolton—A Bill to limit the Powers of Water Companies in Cutting Off the Water-Supply—Mr. Deacon's Water-Meter Patents—Sea-Water for Flushing Bournemouth Sewers—Electrical Prizes offered by the French Government—A Queer Proposal for the Jubilee Year Celebration.

London, February 9, 1887.

The successor of the late Sir Francis Bolton in the post of Examiner of the London Water-Supply is General A. Scott, R. E.

Mr. Forrest Fulton has introduced a bill into the House of Commons to limit the powers of the Water Companies to cut off the tenant's water-supply where the rate is paid by the landlord. The state of the law hitherto has been manifestly unfair and hard upon the tenant. It has been a matter of frequent occurrence, where the water-rate has been an inclusive charge with the rent and has been duly paid by the occupier to the landlord, that the water has been cut off by the water companies for non-payment of rates by the landlord. The bill proposes that the water companies, in such cases, shall no longer have power to cut off for non-payment of rates, but that the charge with 5 per cent. interest per annum shall be the first charge on the house, recoverable from either the owner or the occupier—in the last case being deducted from the rent.

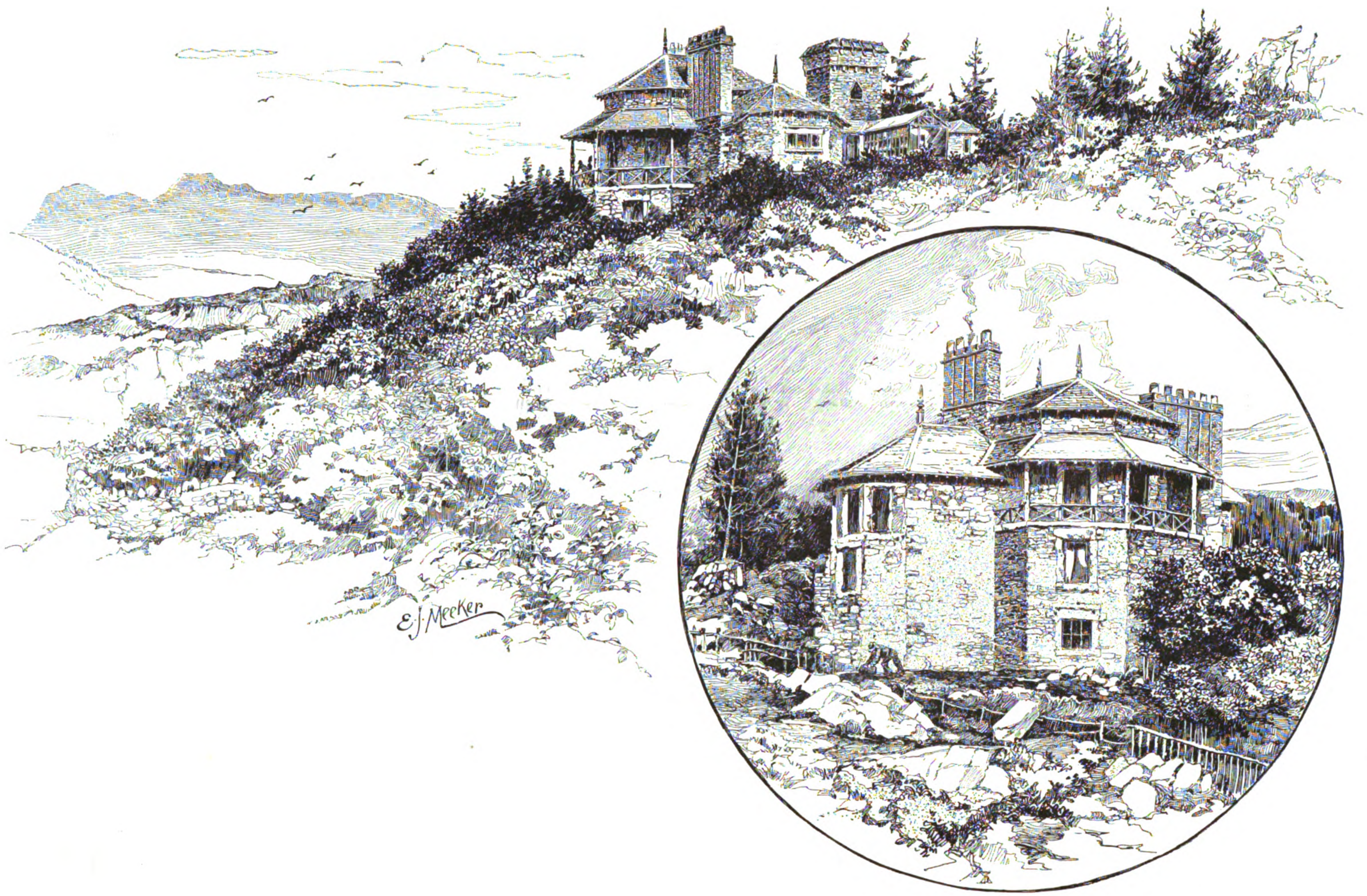
Mr. Deacon, the patentee of the Deacon water-meter, and Engineer to the Liverpool Water-Works, has been granted an extension of time, amounting to three years, as prolongation of his letters-patent. The application for extension was made on the ground that the returns had been inadequate to the value of the invention.

The Bournemouth Improvement Commissioners propose to put forward a scheme for flushing the sewers and streets with sea-water in place of using that from the fresh-water mains. The gas and water company, being large rate-payers, took exception, and, on appeal to the Local Government Board, that body decided the consent of the companies would be necessary before the proposal could be carried into effect. It should be stated that the opposition of the companies was partly on the ground of probable damage to the pipes arising from the salt water. It is natural that the water company, as a private body, would object to its vested interests being interfered with.

The attention of electricians is directed to the offer of a prize by the French Government of 50,000 francs (say $9,500) for a scheme rendering the application of electricity economical and adaptable as a means of heat, light, chemical action, mechanical power, and medical purposes. The decision and adjudication is in the hands of the Academy of Sciences.

The proposals for celebrating the Jubilee Year are, to say the least of it, in many cases very funny. I have already referred to the project for a tower in Trafalgar Square. A few days since I noticed that the local board of a small provincial town had decided to increase the size of its cemetery "in commemoration," but the latest thing is the proposal of Mr. Mark H. Judge, before the Paddington (London) Vestry, to acquire a canal basin and the adjacent property, where dust-collecting and sorting amongst other businesses has been going on for many years past, with a view to converting the site for residential purposes. The abolition of the dust-nuisance would undoubtedly be an advantage, but the scheme for residences on the banks of the canal might be called questionable.

Safety-Valve.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

A HOUSE IN THE ENGLISH LAKE REGION, NEAR AMBLESIDE,

ENGINEERING & ARCHITECTURE

OUR SPECIAL ILLUSTRATION.

A HOUSE IN THE ENGLISH LAKE REGION, NEAR AMBLESIDE.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE AT LAFAYETTE, N. J.—J. D. HUNTER, JR., ARCHITECT.

THE subject of our vignette illustration this week is the residence of Mr. J. W. Hardenbergh, at Lafayette, N. J. The exterior finish of the first and second stories is of clapboards, and the gables are shingled. The parlor, dining-room, and study, and also two principal bedrooms, are finished in redwood. The halls are of American oak, with oak staircases to the attic. The fire-place end of the dining-room is all of wood, with seat and buffet built in on either side of mantel. The cost was $7,000. Mr. J. D. Hunter, Jr., was the architect.

COTTAGE (SMALL) HOSPITAL CONSTRUCTION.

BY HENRY C. BURDETT.

Author of Cottage Hospitals, Pay Hospitals of the World, etc.

No. XIII.*

THE NEW HOSPITAL, STRATFORD-UPON-AVON.

THE plan of this hospital, which was selected out of a number of designs submitted in competition, presents some features which, to any one who is at all conversant with the development of modern hospital planning, are somewhat remarkable.

It has been very generally recognized, both in this country, on the continent, and in America, that the pavilion type of hospital presents advantages not so completely obtainable with the older form of corridor hospitals, and in many of the most recent examples, notably in the barrack hospitals of Germany, the principle of complete isolation of each ward has been emphasized by the adoption of single-story pavilions unconnected with each other or with the administrative buildings by any kind of corridor.

In principle this arrangement is so entirely opposed to the corridor plan, that when the designers of a new hospital deliberately revert to the older type one naturally looks to find some very special and important reason for so retrograde a step.

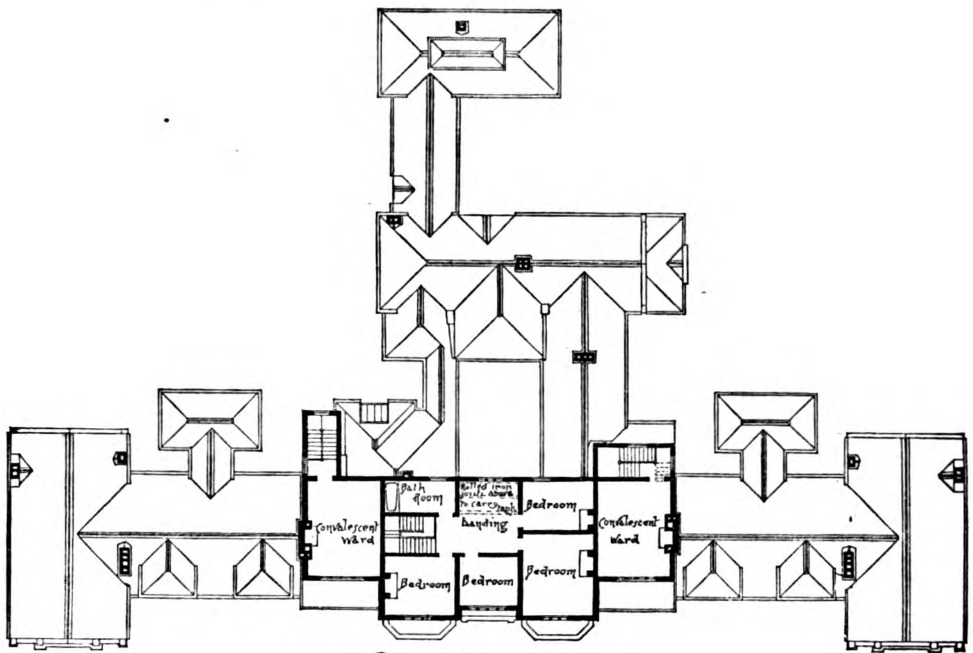
In this instance the corridor plan seems to have been adopted without any apparent reason for so doing or advantage resulting therefrom. The wards are, it is true, on one side only of the corridors, but the space available in the walls of the corridors opposite to the wards is reduced to very small dimensions, and the possibility of a current of air passing from end to end of the corridor is prevented by placing a nurses' room at each end.

The building takes roughly the form of the letter ⊥ reversed—the wards, eight in number, four on each side, being placed along the two extremities of the cross-piece, the centre of which is occupied by the entrance-hall, committee-room, and matrons' sitting-room. These rooms, presumably, all face south (the points of the compass are omitted from the plan), and the corridor runs at the back of them from end to end of the building. In this corridor, 172 feet in length, there are five windows, with an aggregate width of 24 feet; that is to say, that the proportion of window-space to wall-space is about 1 to 7.

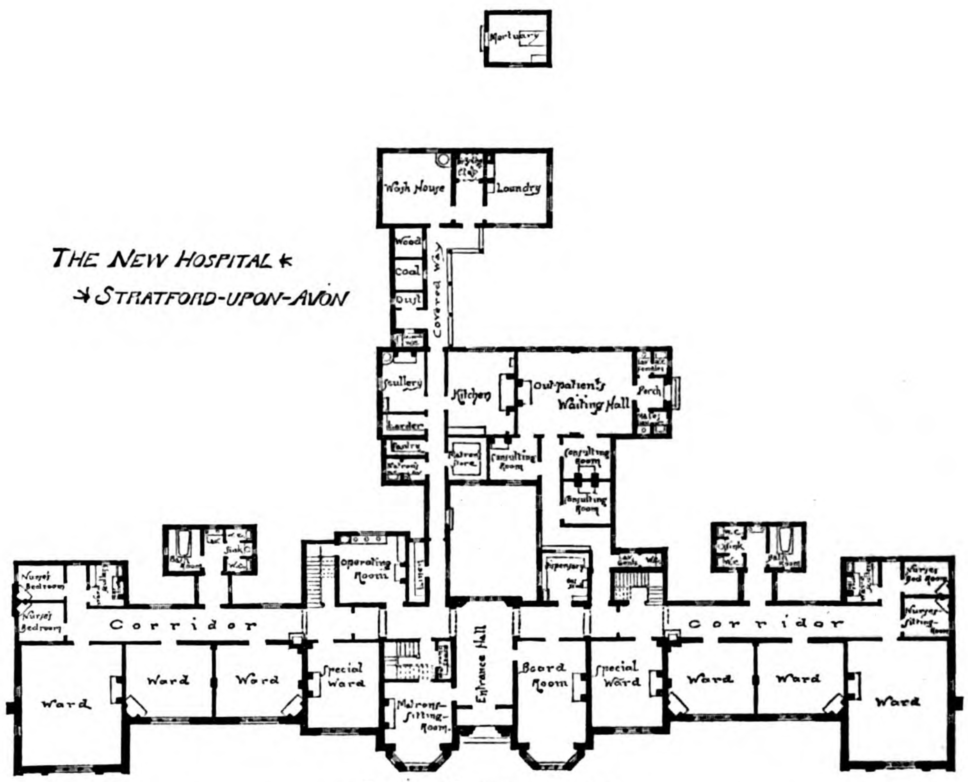
At each end of the corridor are three rooms, two being bedroom and sitting-room, respectively, for a nurse, the third being the ward-scullery. These nurses' rooms are placed in precisely the positions which they ought not to occupy. The nurse's proper place when she is on duty is the ward, or, when occasion requires it, the ward-scullery or duty-room. When off duty she should be as far removed from the ward atmosphere and the ward noises as possible.

The position of the water-closets and bath-room also impedes very materially the capacity of the corridor for purposes of ventilation. These conveniences are built out at the back of the corridor and are separated from it by a cross-ventilated lobby, but the chance of any air blowing through this lobby is rendered very problematical by the relative position of the adjoining projecting parts of the

*No. XII., the Convalescent Home for Children, St. Leonards-on-Sea, was illustrated in our issue of January 8, 1887.



PLAN OF FIRST FLOOR



PLAN OF PRINCIPAL FLOOR

building; in fact the only clear way through the lobby is in an oblique line through one window and the door into the corridor.

The position of the bath-room is an error which has the effect of unduly enlarging the projection of the building which contains it. There is no necessity whatever for cutting a bath-room off by a ventilated lobby from the ward or corridor as a water-closet is cut off; and in a small hospital like this a well-arranged group of about four bath-rooms in some central position would have been infinitely more convenient and economical.

The administrative department, though open to criticism in several points, is, on the whole, better arranged than the wards.

The matron's two store-closets and the linen store should have been grouped together, and the linen store might with advantage have been a room of sufficient size to allow of a table for sorting and mending.

The kitchen and scullery should not have been separated by a passage. In a hospital the communication between these offices should be as free as possible.

Beyond the kitchen offices are outbuildings containing coal and wood store and a small laundry.

The out-patient department consists of a large waiting-hall and three consulting rooms. The water-closets for male and female out-patients are not well placed, being face to face across a narrow passage.

The mortuary is a small detached building containing one room only, destined, apparently, to serve the double purpose of post-mortem room and dead-house.

There is an upper story over part of the building containing bedrooms and bath-room for the staff and two convalescent wards, the two latter having independent staircases and are each provided with a balcony.

The drains are in two separate systems, one for rain-water, the other for sewage and waste-water.

The rain-water drains are led into an underground tank which has an overflow-pipe communicating with the soil-drains.

The soil-drains are principally remarkable for the number and variety of their curves and for a certain elaborateness, the purpose of which it is not easy to divine. Ventilating pipes appear in quite unexpected places, and while due care seems to have been taken to properly disconnect the waste-pipes from sinks, baths, and lavatories, there does not seem to be in the whole system any means of inspection or any provision for flushing.

There is a syphon-trap between the hospital drains and the sewer, with a ventilating shaft on the upper side.

THE LANCASTER CREMATORIUM.

THE accompanying illustrations show the building and retorts lately erected by the Lancaster Cremation and Funeral Reform Society at Lancaster, Pa.

The building is of brick, 48x32 feet, with iron roof, and a very good idea of its external appearance can be obtained from our illustration—which, by the way, was taken before the grounds were laid out and improved. It is divided into four apartments, as shown in corner of vignette, with room for two furnaces or retorts near the centre. The front room or auditorium is the largest, 23x32 feet. It is here the ceremony selected by the friends is held, and from which the body is put into the retort, the door of which opens into this room. On either side of the retorts is situated a small room; one of these is used as a waiting-room for the friends who may accompany the body, and the other for the preparation of the body for incineration. In the rear is situated the furnace-room where firing is done, and where all tools and miscellaneous articles are kept. There is little in the general appearance of the building suggestive of its use, the chimney being disguised in a small observatory on top of the roof.

The floor of the auditorium is made of Portland cement; the other parts of the building are floored with brick. The audience-room is furnished with chairs and a table for the use of ministers or the officers of societies having charge of the ceremonies at cremation, and the walls are decorated with pictures and urns of various designs. The waiting-room is provided with chairs, lounges, toilet-stand, etc., for the comfort of the waiting friends. The grounds consist of a plot of two acres, one-half of which is level; here the building is located. The other half is a hillside of limestone rock, where the society intends erecting columbariums at an early day. The grounds about the building are laid out into roadway and walks, and trees and shrubbery are cultivated.

The furnaces and retorts are, however, the more importatn objects of our article, as the plan of any building will always be varied to the ideas or wants of a society, while the forms for retorts and furnaces must follow some conventional or practicable design and be within definite limits. The furnaces and retorts used in this case (Fig. 2) are from plans by M. L. Davis, M. D., one of the originators of the society. They are two in number and placed side by side —one being omitted in our plan. They occupy a space thirteen feet wide by ten feet six inches long by about eight feet in height. The outside walls are two (Pennsylvania) bricks in thickness, or about nine inches. The furnace or fire-chamber F is eighteen inches wide by forty-eight inches long and three feet nine inches between grate and crown of arch. It is lined with two thicknesses of fire-bricks on the sides and with a fire-brick arch on top, with a "shield tile" three inches thick interposed between the arch and bottom tiles of the retort. The retort is nine feet nine inches long by three feet wide and two feet high in the clear. The bottom is made of special fire-clay tiles three inches thick, with lapped edges. The side tiles are similar and also in sections, lapped at the edges, and the roof is made of arched tiles, all three inches in thickness. It is made in sections, in preference to a single piece, the better to withstand the great heat (about 2,000° Fah.), without cracking and to facilitate repairs, etc.

The products of combustion and the heat pass around the retorts in flues 15x3 inches. They leave the furnace through the openings Q Q, pass to the top through the passages A A, pass down again through B B, and escape to the chimney by C C.

Between the outside facing of the flues and the 9-inch brick walls is a space, marked "expansion chamber" on the cross section (Fig. 2). This is three inches wide, and is packed with loose asbestos to prevent radiation and conduction of heat, and for expansion and contraction of outer side of flues without affecting outer walls. The space above the upper arch is filled with ashes and sand and floored with common bricks to complete finish and prevent loss of heat in that direction.

The retort-door and frame are of cast iron, the former being lined with asbestos and fire-clay. The frame is held in place by two horizontal bars built in at the ends in the solid masonry. The door is fastened by a spider, upon which is screwed an arm swinging with the door that locks it with the frame. The whole structure of the retorts and furnaces is bound by three pairs of buckstays fastened at the top in pairs by iron rods and nuts to allow of adjusting. The chimney in the clear is 16x14 inches and rests on supports of T-irons set on brick piers in walls, and it is lined with fire-brick for a height of six feet above retorts. The height from ash-pit floor to grate is fifteen inches.

The pipe P is to supply air to the retort in varying quantities as required. The pipes M N are to lead the gases and other products of distillation from the retort and deliver them under the grate, where they may pass through the fire. The pipes E E on cross-section supply air to the flues at E, longitudinal section, for the purpose of producing secondary combustion.

As fuel they use coke and hard coal, though gas, oil, or any other heating material may be used. The quantity required varies somewhat, but the average amount necessary to heat the furnace and incinerate a body has been 250 pounds of coke and 250 pounds of coal, or about one-fourth ton of fuel. The time occupied for complete incineration varies according to the condition of the body, but ranges from forty-five minutes to one hour and a half. The furnaces can be heated in six hours, but they usually occupy more time in heating, as there is less liability of injury to the furnace by rapid expansion.

Cremation at this crematorium is as follows: The catafalque, shown in Fig. 3, bearing the crib, which is covered with a cloth fifteen feet long wet with alum-water, is placed by the side of the casket containing the body, the lid of which is removed and strips of muslin are passed under it. The ends of the bands are attached to an elevator, and the body is gently raised up and placed upon the alum-sheet-covered crib, the free end being covered over the body, thus entirely enveloping it. This procedure is necessary to prevent the clothing in which the corpse is dressed from igniting. The body and catafalque are then covered with a large pall. All being in readiness, a door leading to the auditorium is opened and the catafalque, on noiseless casters, is moved to the audience-room and placed in front of the retort.

The face of the corpse, if desired, is then exposed, and religious services, such as the friends may select, are held. At the close of these exercises a cable is attached to the crib, the retort door is opened, a signal is given to the attendant, and the catafalque with its burden is drawn into the open retort. When it is in the proper position the door is quietly closed air-tight and the process of incineration begins.

When the retort is opened to admit the body the cold air chills for a few moments the inner surface of the retort, but in a few moments, however, the retort regains its heat and a fine mist commences to arise from the body, which gradually becomes thicker and more dense, until the inside of the retort has the appearance of dense white mist. This appearance remains until the soft tissues are reduced to ashes. Then the interior of the retort gradually becomes more clear. The alum sheet will be seen to be in the same position as when put in, but slightly sunken. A blue flame

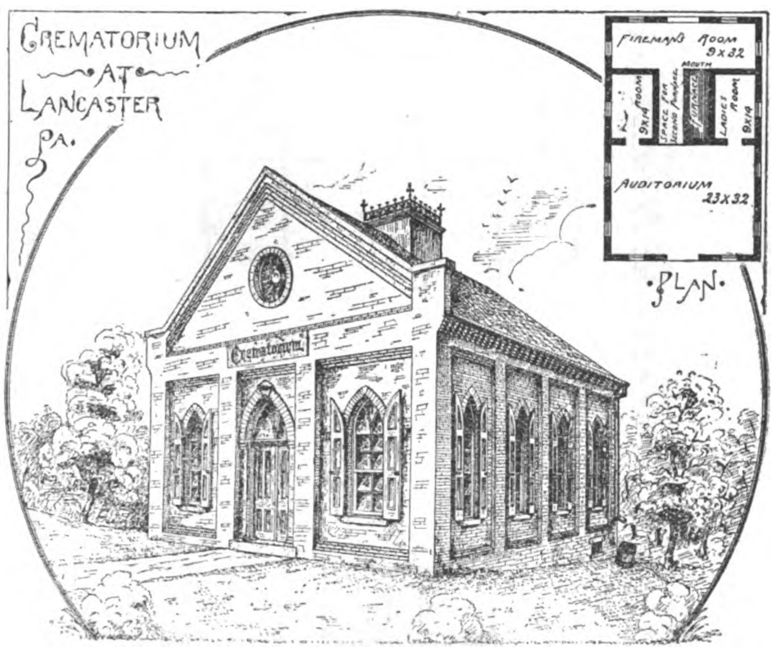


FIGURE 1.

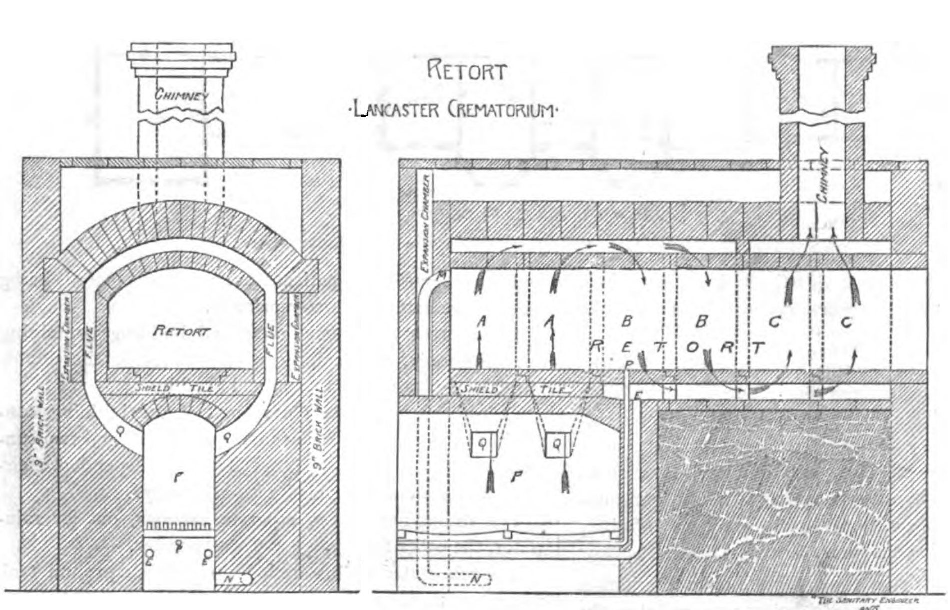


FIGURE 2.

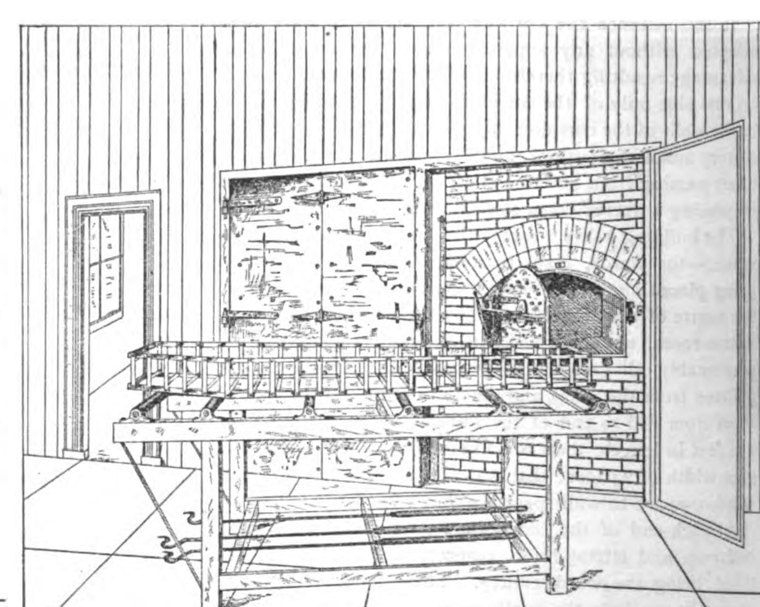


FIGURE 3.

will be seen arising through the sheet ; about six inches above the body it becomes extinguished. This continues until the bony structure is completely cremated, and nothing can be seen inside the retort, the ashes having fallen through the crib and the alum cloth collapsed.

As many persons have contended that poisonous gases are given off from the dead body during cremation the society had Prof. T. R. Baker, of the State Normal School, collect and analyze the products of combustion both before and after the body was placed in the retort, with the following results. The estimated amounts of the gases enumerated above are as follows, the values indicating the parts of a cubic inch to the gallon, the estimated water being also included in the table :

	H_2O	CO_2	Illuminating-gas.	O	CO	N
Before Cremation.......	.0011	.00080	.000	.0080	.0000	.016
During Cremation......	.0044	.00091	.012	.0065	.001	.015

The water through which the gases were passed, both that used before the body was put in the retort and that used during the cremation, had a distinct acid reaction, quickly reddening blue litmus paper. He could not, however, detect any difference in the degree of acidity of the waters, and their reaction did not indicate that the gases which had passed through them were more acid than the gaseous products passing off from ordinary coal-fires. The waters were found to contain traces of the mineral acids generally found in very small quantities in the products of the combustion of mineral coal. They gave no reaction for salts of ammonia nor for sulphureted hydrogen.

The gases collected for laboratory examination were tested especially for carbonic acid (CO_2), illuminating-gas, oxygen (O), carbonic oxide (CO), and nitrogen (N).

The method of examination employed was that generally followed in gas analysis—namely, the absorption of the gases by liquid reagents. Carbonic acid was absorbed by potassium hydrate, illuminants by bromine, oxygen by phosphorus, and carbonic oxide by cuprous chloride dissolved in hydrochloric acid.

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

No. IV.

(Continued from page 290.)

It is not generally known that rocks which are hard, and subject to almost no decomposition in one climate, may be thoroughly decomposed to great depth in another. Such a decomposition seems to be going on in the gneiss of New York Island. The water taken from the artesian wells of this city, and of the vicinity, often contain from 12 to 20 grains to the gallon of mineral matter in solution, and some of these, which have been sunk to the depth of 700 feet and over, contain from 6 to 13 grains to the gallon of carbonate of soda, showing that the rock is undergoing decomposition at great depth as well as at the surface. It has generally been supposed that the brackishness of our artesian-well water was owing to the fact that the dip of the strata is such as to bring towards the centre of the island, from both sides, the salt water of both the rivers, but this could not explain, even if it were true, for such depths the presence of such large quantities of carbonate of soda. I have seen gneiss in North Carolina so thoroughly decomposed over a large area, and to a great depth, that it was soft like clay. In the vicinity of Van Tyne's Station, on the Richmond and Danville Railroad, there is an outcrop of a gneiss rock so decomposed that, while preserving to the eye alone all the characteristics of an unaltered rock, it can be made into balls like clay. This decomposition has been traced to a depth of 250 feet. In the same neighborhood is a trap-dike, over 60 feet wide, so thoroughly decomposed that it can be shoveled up like dirt, with no indications that it ever was a rock, except that here and there there are boulders 10 or 12 inches in diameter with an outside crust like the dirt, but a little harder, but having the unaltered rock in the centre. I traced this dike for half a mile, and found it everywhere in the same condition. The railroad cuts through it in one place where the sides of the cut are over fifty feet high, showing the rock thoroughly decomposed from top to bottom. Such decomposition is quite common in modern volcanic rocks, and the soils which they furnish are much sought for by the wine-growers.

Mica slate is composed of quartz and mica. It is of necessity laminated, and contains a large number of minerals included within it. It is fusible and not very suitable for structures above ground, nor hardly for those below. The mica is generally biotite. It frequently is so rotten, from the action of decomposing pyrites, and from the decomposition of the mica, that it is unfit for anything but gravel. Such material when thoroughly rotted makes good roads and hard walks. It is sometimes used in buildings, but not often above ground. Its decay is not very rapid, but is quite sure in time, if the mica predominates, as it usually does.

Under the name of trap, several varieties of stone are included. As they cannot usually be got in large pieces, on account of their brittleness, they are used only occasionally for buildings, when they do not have to be carried any very great distance. They are composed mostly of a triclinic feldspar, which is often labradorite with pyroxene, peridot, magnetite, menaccanite, sometimes apatite, and a mica which is generally biotite. They are almost always accompanied by some form of chlorite, which is usually a product of decomposition. They are often full of small cavities which are lined with chalcedony and the zeolitic minerals. The decomposition seems to be caused by the solution of certain parts of the rock and a greater or less precipitation of the elements dissolved in the stone itself. The rock is usually tender and brittle while the quarry-water is in it, and quite tough afterwards. Its decomposition is exceedingly slow. No great buildings have been made of it, on account of the impossibility of getting it in large pieces.

Serpentine is a hydrated silicate of magnesia of variable composition, and associated with a number of minerals of the same general composition. It is also a product of decomposition of other minerals. It is a tough but soft stone, and may be in all conditions from roughly lammellar to almost granular. It is associated with chromite and magnetite, and frequently contains considerable quantities of calcite, and with certain fibrous minerals, which are sometimes a variety of the rock itself, and sometimes fibrous varieties of the amphibole series. When it is contained in calcite it is often used as an ornamental stone. Not unfrequently it is associated with the variety of steatite known as soapstone, when it becomes a serious impediment to the use of the steatite. Both stones have been used for building, although they are so soft as to be unsuitable for large structures. They have stood in some places where they have been used for 150 years ; in others they have commenced to decompose in a much shorter time. This is owing to the variable nature of the rock, which is rarely ever homogeneous, either in composition or structure. When they are quite pure, both steatite and serpentine, though so very soft, are practically indestructible rocks. They are not generally, however, suited for use in large cities, on account of the considerable quantities of carbonates they contain, which are easily acted upon, and cause the stone both to lighten in color and disintegrate on account of them. They can generally only be had in small pieces, which is objectionable in a building-stone.

Under the name of porphyry are included a very large number of stones which have a compact, generally dark-colored base, with crystals either of feldspar or of quartz of a different color showing in them. These are generally either quartz or some kind of feldspar, or both. They usually occur in dikes. The stone is very hard and tough, and generally can only be had in small pieces. It has many different varieties of color, both of base and crystal, and is a very beautiful stone. It was very much sought for by the ancients, and was extensively used, both for construction and ornament. None of these stones used in their buildings show any trace of decomposition, and those found in the ancient ruins show only a slight diminution of the polish, which, where it was made very high, seems almost as indestructible as the stone itself. In places, however, it is quite frequently decomposed. I have seen considerable quantities of it decomposed to a clay, looking exactly like the unaltered rock, even to the colors of the crystals, with every ingredient, except the quartz, turned into a plastic clay, so soft that it could be easily molded in the hand. This decomposition has, however, so far as I know, only been found *in situ*. The same kind of decomposition takes place in the conglomerate rocks of Lake Superior, which are porphyritic, when all the constituents of the rock, except the quartz, are sometimss formed into a soft clay. The entire replacement of the base of the rock by native copper is quite common, both in the conglomerate and amygdaloid rocks of that region.

Slates are little used in construction, both from the difficulty of getting out large blocks, on account of the ease with which they cleave, and also because of the unattractive color which most of them possess. They are sometimes used for building in the vicinity of large quarries, only those pieces, however, being used which do not readily cleave. They must always be placed in their quarry-bed. When placed in a vertical position they are very apt to laminate, but in the quarry-bed they have stood for hundreds of years. Some varieties are subject to a superficial decomposition, which changes the color to an unpleasant yellowish-gray, but it is very slow. When the slate contains pyrites its use must be avoided. Slates cannot be carried far, as they are not much esteemed, but they are a durable stone when of good quality, and only objectionable on account of their color. They are used chiefly for roofing purposes, but are being gradually superseded of late years on account of their weight, it being more expensive to build a roof strong enough to support slate than one for a lighter roofing material. In the older parts of the city, where the Dutch traditions were still in force, the roofs were almost invariably made of slate and tile, and placed at an angle of 45 degrees, so as to prevent the accumulation of snow upon them. Tile having been found altogether unsuited to this climate, was abandoned entirely ; but slate continued popular until tin and other materials began to supersede it, as they are now doing to a great extent. It is not ordinarily subject to decomposition, and when this does take place in it, it is usually attributed to the presence of pyrites. I have, however, within a year, seen, on the roof of a house in Massachusetts, rather thick roofing-slates, entirely free from pyrites, which were placed there twenty years ago, so decomposed that they will not bear the least pressure, and are broken into small pieces by the force of the wind. This decay is accompanied by a change of color; originally bluish-black, it changes almost to brown. After a little while, such slates will not only be no protection to the roof, but their presence will be an absolute detriment. This form of decay, however, is not found in slates of good quality, and is more of a lithological curiosity than a real danger to be guarded against.

Slate was formerly much used for ornamental purposes, and where that of good quality was selected it answered perfectly well, as it is capable of receiving very high polish. Owing, however, to the difficulty of securing a slate which was compact and hard, this use of them seems to have been abandoned. They are, however, still extensively used to make enameled surfaces for interior decoration. The old graveyards of New England contain many tombstones of slate dating back nearly to the close of the seventeenth century. Most of the slate headstones in Trinity churchyard are to all appearances entirely unaffected, and seem to be as strong and perfect as on the day they were placed there. Two of these were erected in 1691 and 1692, on the north side of the church, and were cut on both sides. One of them, that of 1691, shows no sign of deterioration, except an occasional spalling of very small pieces ; the inscription is quite sharp. The other is very much broken on the lines of pseudo-cleavages, produced by pressure ; but the surfaces of fracture, though produced many years ago, are quite fresh. The faces of both these stones are somewhat gray from alteration.

Of the different varieties of marble, those which are granular are the ones which are generally most easily attacked, and of the limestones and dolomites, the former seem to be most readily acted on, while those marbles which are composed of a mixture of limestone and dolomite are very easily affected by the weather, the limestone going first and leaving the dolomite. Most of this weathering takes place on buildings in the country, or standing by themselves, by the decomposition of the minerals contained in the interior, which can easily be prevented by proper selection of the stone. Where the buildings, however, are in a confined space, especially in large cities, the action of the city gases is such as to attack the limestone, leaving the less easily affected dolomite altogether uninfluenced at first, and afterwards, according as there is more or less of lime present in it, causing it to crumble, or leaving a very rough surface. There are a number of notable examples of this decomposition in some of what were once the most beautiful tombs in our city churchyards, which have literally fallen in sand by the solution of the lime by the city gases. The commencement of this action may be seen on the monument to Alexander Hamilton in Trinity churchyard, and on the Emmet monument in St. Paul's. The same action is frequently seen in the dolomite quarries, as at Lee, Mass., where the limestone is dissolved out, leaving the dolomite as a sand with crystals of tremolite lying loosely in it.

The churchyards of the country also are full of stones undergoing this kind of decay ; which, however, progresses much more slowly there than in the city. One of the most remarkable instances of the decay of stone can be seen in the southern division of Trinity churchyard near Broadway, about half way between the church and Rector streets, in the shape of a square marble monument with an inclined top now about four feet high. Originally this was twelve feet high, supported on polished columns, with an open space underneath, in the centre of which was an urn. This monument was erected in the year 1820 to the memory of Grace Lyde. It was made of highly polished marble, and when it was put up was one of the most beautiful and graceful monuments ever erected in any of our city churchyards. In the year 1860, the name on the monument had already become illegible. About five years ago it was in danger of falling, and an order was given by the church authorities to repair it. It was found, however, that the stone was so badly decomposed that it would not hold together under the pressure of its own weight, so that the monument could not be repaired. It had to be taken down. All of it that could be used was put up in its present shape. The decay has still further progressed since then. The stone is so soft that it easily crumbles between the fingers, and it is rapidly falling into sand. The inscription has entirely disappeared, and in a few years longer nothing will be left of it but sand. The Capitol, at Frankfort, Ky., was built in 1837 of a very fine-grained limestone, with some excess of carbonate of magnesia. This has become acted on, so that the building is completely coated with what appears to be a very fine wash, which is very adherent, but can be easily scraped off with a knife. It consists of carbonate of lime. The interior of the stone has suffered no decay.

As a general rule when a limestone contains much pyrites it should be discarded, but it does not always follow as a necessary consequence that the presence of pyrites in stone is of necessity a disadvantage. As a general rule the presence of marcasite is. Of the ordinary pyrites some varieties do not decompose, while others do ; the presence of such varieties as decompose may disfigure the stone, if in small quantities only, or may cause it to swell and disintegrate if in large quantities. In compact stones its presence has but little influence ; in porous ones it is generally objectionable. But no absolute rule should be laid down, for, while as a general thing it is to be avoided, it may be harmless. In general it may be said that the presence of much pyrites makes the stone unfit for use in the exterior of buildings. It is often a matter of surprise that some limestones do not stand here, either in houses or in graveyard monuments, for

* A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

any great length of time, while they have stood for thousands of years both in Italy and in Greece. This is, however, very easily explained, from the fact that in these countries in the situations where they have stood, the air is comparatively dry, and also does not contain so much, if any, of the injurious gases which affect our stones. In looking over our churchyards—Trinity, St. Paul's, St. John's, and Trinity Cemetery—we find that the effect of weathering upon the marble is very curiously developed. If the stone is placed vertically, according as it is more or less compact, or is composed entirely of carbonate of lime, or partly of lime and dolomite, the polish on the stone will be very much deteriorated in the course of ten or fifteen years, and may, on certain stones, sometimes be entirely gone in less than that time.

There are many stones in Trinity and St. Paul's churchyards, placed there within the century, where the inscriptions have been entirely obliterated, leaving in their place a very rough surface, which scarcely shows any trace of the stone ever having been worked. In Trinity Cemetery, at One Hundred and Fifty-sixth Street and North River, where the air is much purer than it is in the city, some of the marble headstone have become so rotten after twenty years' experience that they will not bear their own weight, and crumble from the least friction, even of the hand. As a general rule the finer the texture and the closer the crystals are arranged in the stone the less this disintegration has taken place. The monument erected in 1814 to the Sieur Rochefontaine, who commanded the French forces during the Revolution, was so far decomposed that in the year 1885 the inscription was recut by order of the Corporation of Trinity Church. The monument not far from it, erected to G. F. Cook, the famous actor, by Edmund Kean, in 1821, was repaired by Charles Kean, in 1846, and again by E. A. Sothern in 1874. Except on the south side the inscriptions are now very much defaced. It was necessary to recut the inscription on the monument to Alexander Hamilton in Trinity churchyard in 1885. The monument to Alexander Bradford, New York's first printer, erected in the year 1752, was so far defaced and crumbled that in the year 1868 the corporation put up a *fac-simile* of the original stone. This is so far acted on already that sand can be brushed off its surface with the hand. The inscription on the altar tomb near that of Alexander Hamilton, in Trinity churchyard, is so far defaced from the solution of the stone that only a slight depression, where the lettering once was, can be distinguished on the surface of the stone. As the result of the examination of the New York City cemeteries, I am confirmed in the opinion that, in general, limestone, whatever its character, is entirely unsuited in this climate for the construction, in cities, of monuments which are to be exposed to the air. One of the most remarkable destructions of this kind which has ever come within my observation is that of the cathedral at Douai, in France; the whole of the outside coating of Caen stone of this church is gone, leaving nothing but the filling of the brick and rubble to support the interior of the church. It is said that the whole of the outside of Westminster Abbey has already been replaced twice, and will soon have to be replaced a third time. The exterior of Cologne Cathedral was hardly finished before they commenced to repair it. Notre Dame and the Tour St. Jaques, in Paris, require constant attention and repair.

The rate of disintegration in such stones used for buildings can be very much lessened by filling the pores of the stone where decay has already commenced, or previous to its being put into the building, with some substance like oil, paraffine, or sulphur. In the case of the experiments that have been tried upon the Houses of Parliament, it has been found that sulphur in solution has answered better than any of the other substances used as a remedy against this decomposition. It has also been found that the filling of the pores of that stone is generally useless if it has been done on the outside only. I saw several cases where the pores of the surface only of the stones, having been filled with sulphur, had retained their surfaces during twenty years of exposure, and were only just beginning to exfoliate. Where the remedy has been applied to the six sides of the stone previous to its being put into the structure, it seems to have been effective, such stones, after ten or fifteen years of exposure, showing no signs of decay.

Almost everything has been tried on the Houses of Parliament, but nothing as yet has been found to be successful. This is owing partly to the fact that a large proportion of the stone was unfit to put into any building under any conditions. The commission which selected the quarry from which the stone should be taken was discharged when their report was made, and no one was responsible for the stone selected after this quarry was found to contain an inadequate supply; and when it failed, stone was obtained almost anywhere that it could be had. The destruction has been so rapid, and the decomposition of their highly ornamented surfaces has extended so far, that in the case of finials and the small pinnacles which they surmount, they are now replaced by cast-iron painted the color of the stone.

From want of care in its selection, I have seen the *calcaire grossière* of Paris decompose so rapidly, that the stones had to be removed after a few years. Up to 1860 there were on the side of the Louvre, next the Seine, between the passages that enter the Place du Carousel next the Tuileries, large stones which had fallen entirely into sand to a depth of over six inches, and the remaining portion was so soft that it could be picked to pieces with the finger-nail. This same decomposition took place also in certain sandstones with a calcereous binding material, which was much used in Paris at this time. I have often gathered fossils in the sand of the quarries from which both these kinds of stone were taken, certain beds of them on the outskirts of Paris being the favorite resort of fossil-hunters. In this case there was both the original want of consolidation of the stone and subsequent decay to make it weak.

The silicates of soda and potash with which the surface of the Louvre in Paris was washed in 1858, seems to have been quite effectual. In this case a silicate of lime was formed, which has protected the surface from further action of the weather, but on the Houses of Parliament, owing to the bad quality and the extremely soft and porous nature of the stone, which required that the pores should be filled at the same time that the surface was indurated, it does not appear to have been successful.

Some years ago attempts were made to introduce Caen stone into this country, as it had proved so satisfactory in many buildings in England and France. A number of houses of this stone were erected both in New York and Brooklyn. About the same time the interior of Trinity Chapel, on Twenty-fifth and Twenty-sixth Streets, was lined with this stone. In less than ten years the Caen stone used on the outside of buildings in Tenth Street, between Fifth and Sixth Avenues, began to exfoliate, and the fine carving crumbled to pieces before anything could be done to preserve it. The rest of the front of some of these buildings has been preserved till this time only by keeping it constantly and carefully painted. To be effectual, this paint must be renewed every four or five years. The interior of Trinity Chapel, however, shows no trace of decomposition of any kind. The stone is a little clouded with dirt, but otherwise is apparently as sound as the day it was erected, showing that Caen stone is perfectly suitable for interior decoration when kept dry. Soft stones of this character can only be used in outside work in large cities by being kept constantly coated with paint.

(To be continued.)

STANDARD PIPE AND PIPE-THREADS.*

Your committee to whom was referred the consideration of a standard for pipe and pipe-threads have the honor to present the following report:

At a meeting of your committee held in Hartford, February 23, 1886, the request embodied in the following circular-letter to the manufacturers of wrought-iron pipe in the United States was decided upon, and the letter was issued April 21, 1886, addressed to each of the companies composing the above association:

"At the sixth annual meeting of the American Society of Mechanical Engineers, held in Boston, in November, 1885, a committee was appointed by the president to confer with the manufacturers of pipe, pipe-dies, and pipe-fittings, with a view of bringing about a uniformity in the sizes of pipe and pipe-threads, and of maintaining it by the use of gauges which shall definitely represent standard sizes.

"A meeting of this committee was held in Hartford, February 23, 1886.

"The opinion of this committee is that the Briggs Standard, which nearly all if not all of the pipe manufacturers once adopted, is the proper standard to be adhered to, and that it only requires definite co-operation on the part of pipe manufacturers with the committee, in order to bring their product strictly to that standard, and to adopt means of strictly adhering to it within practical limits.

"A copy of the minutes of the Boston meeting referred to is herewith mailed to you, in which will be found the report of the discussion and subsequent recorded appointment of the committee. There is also sent you a copy of the paper upon this subject, which was read at that time before the society, together with the report of the discussion which followed its reading.

"The committee request that the pipe manufacturers give this matter consideration, and would suggest that they appoint a committee to confer with them, with a view of bringing about the desired result, and to notify the secretary as to the date when this meeting may be held.

"Will you please give your individual aid in having such a committee appointed?

"An early answer will oblige,

"Yours very truly,

(Signed) "George M. Bond, Secretary.

"Frederick Grinnell, Chairman.
"George Schuhmann.
"William J. Baldwin.
"B. H. Warren.
"George M. Bond, Secretary.
Hartford, Conn, April 21, 1886."

There was also issued a circular-letter to each of the members of the Associated Manufacturers of Cast and Malleable Iron and Brass Fittings in the United States. This letter was dated April 28, 1886, and is as follows:

"The enclosed communication which has been sent to each of the pipe manufacturers, will explain itself.

"A copy of extracts from minutes of the proceedings is also enclosed.

"We will be pleased to have your views upon the subject for our guidance in conferring with the proposed committee of pipe manufacturers.

"Yours very truly,

(Signed) "George M. Bond, Secretary."

As stated in the preliminary report of your committee, submitted at the meeting of this society, held in Chicago, May, 1886,* a committee was appointed by the Manufacturers of Wrought Iron Pipe and Boiler Tubes in the United States, at their meeting held in Philadelphia, May 12, 1886, the members of which committee, as at that time given, being:

Mr. L. W. Shallcross, Chairman, representing Messrs. Morris, Tasker & Co., Limited, of Philadelphia;

Mr. J. H. Flagler, representing The National Tube Works Co., of McKeesport, Pa.;

Mr. L. J. Piers, representing The Allison Manufacturing Co., Philadelphia, and

Mr. James H. Murdock, of Pittsburg, Secretary to the committee.

The action taken by the Cast-Iron Fittings Association is also here given:

"At a meeting of the Cast-Iron Fittings Association, held in New York, May 19, 1886, the following resolution was unanimously adopted:

"'*Resolved*, That a committee of five (5) be appointed to take into consideration the matter of a standard gauge of thread.'

"The following gentlemen were named as such committee:

"Mr. R. T. Crane, President Crane Bros. Manufacturing Co., Chicago, Ill.

"Mr. C. C. Walworth, President Walworth Manufacturing Co., Boston, Mass.

"Mr. E. G. Burnham, Vice-President The Eaton, Cole & Burnham Co., Bridgeport, Conn.

"Mr. Charles Jarecki, President Jarecki Manufacturing Co., Erie, Pa.

"Mr. Charles W. Nason, President Nason Manufacturing Co., New York City."

The action taken by the Manufacturers of Brass and Iron, Steam, Gas, and Water Work of the United States, at a meeting of their association, held in Pittsburg, May 11, 12, and 13, 1886, was that the following resolution was unanimously carried:

"*Resolved*, That this association favors the establishment of a universal wrought-iron pipe gauge, to be used as a standard throughout the United States, and that any action taken by the manufacturers of wrought-iron pipe to accomplish this object shall have our hearty co-operation."

Soon after this preliminary report was submitted at the meeting of the society in Chicago, in May, a joint conference of the committee appointed by the manufacturers of wrought-iron pipe, and your committee, was held at the Fifth Avenue Hotel, New York, June 17, 1886. The result of this conference is clearly stated in the official notification issued by Mr. L. W. Shallcross, chairman of the conference, and which is here given:

"New York, June 17, 1886.

"At a meeting of the Standard Pipe and Pipe-Thread Committee of the Manufacturers of Wrought-Iron Pipe and Boiler Tubes in the United States, held at the Fifth Avenue Hotel, this day, Thursday, June 17, 1886, at 11 o'clock A. M.

L. W. Shallcross in the chair.
James H. Murdock, Secretary.

Present:—
Morris, Tasker & Co., Limited, L. W. Shallcross.
National Tube Works Co., J. H. Flagler.
The Allison Manufacturing Co., L. J. Piers.

"Also, present in conference, members of the Standard Pipe-Thread Committee of the American Society of Mechanical Engineers, as follows:

"Frederick Grinnell, chairman of committee, President Providence Steam and Gas Pipe Co., Providence, R. I.

"George M. Bond, secretary of committee, of The Pratt & Whitney Co., Hartford, Conn.

"George Schuhmann, of the Reading Iron Works, Reading, Pa.

"William J. Baldwin, 96 Fulton Street, New York, Steam-Heating Engineer.

"On motion of Mr. Flagler, seconded by Mr. Piers, that each manufacturer send to The Pratt & Whitney Co., Hartford, Conn., sample pieces of their pipe from six inches diameter down, threaded on one end, to be tested by the Pratt & Whitney Co., with the Briggs standard, and a report to be made by them to each manufacturer of the state of his gauges only, as compared with the Briggs standard.

"And the secretary be hereby instructed to notify the manufacturers, and request them to comply with this resolution without delay, so that action can be taken at the meeting of July 20th, proximo.

"Unanimously carried.

"On motion, adjourned to meet at the call of the chairman. L. W. Shallcross,
Chairman of Committee.

"Attest—James H. Murdock
Secretary to Committee."

In accordance with the foregoing request, there were received by the Pratt & Whitney Co., for the required test, samples of pipe with threads cut on one end, which your committee has every reason to believe represented the average sizes of pipe and pipe-threads as ordinarily manufactured.

Samples were received from the following manufacturers of wrought-iron pipe, members of the association:

Messrs. The National Tube-Works, Co., McKeesport.
" Reading Iron-Works, Reading.
" A. M. Byers & Co., Pittsburg.
" Spang, Chalfant & Co., Pittsburg.
" American Tube and Iron Co., Middletown, Pa.
" Conshohocken Tube Co., Conshohocken.
" Crane Bros., Manufacturing Co., Chicago.

* Report of the Committee of the American Society of Mechanical Engineers, read at the New York Meeting of the Amer. Soc. of Mechanical Engineers, and reprinted from the Eighth Volume of the Transactions.

* Vol. VII. Transactions A. S. M. E., p. 414.

Messrs. Morris, Tasker & Co., Limited, Philadelphia.
" Fieldhouse, Dutcher & Belden, Chicago.
" The Allison Manufacturing Co., Philadelphia.
" James Hooven & Son, Norristown, Pa.
" Delaware Iron Co., New Castle, Del.

The Pittsburg Tube Company, their new works not being at the time in operation, stated that their sizes would in general conform to those sent by the American Tube and Iron Company.

The examination and test of these sample pieces of threaded pipe was not made until August 23 and 24, 1886, owing to the late arrival of several sets necessary to complete the list. After having had the set of Briggs standard reference gauges critically verified by the Pratt & Whitney Co., the test was conducted under the conditions of confidence which was accepted by your committee, the secretary only to have personal knowledge of each manufacturer's variation. The results were collected and were arranged in tabulated form, each column being headed with a special number which referred to the manufacturer there represented.

This tabulated report, with general deductions appended, was submitted to the Pipe Manufacturers' Association at their regular convention held at the Continental Hotel, Philadelphia, August 25, 1886, and soon after reports to manufacturers individually were sent by the secretary of your committee, as requested in the resolution adopted at the conference.

The variation from the Briggs standard, as found to exist under this test, did not seem to warrant a departure from the original standard represented by the Briggs gauges, and confirmed the opinion of your committee that the Briggs standard could be adhered to.

With the exception of the three-quarters and one inch sizes but comparatively little change would be required in the dies used by the pipe manufacturers in cutting pipe made by them for the market.

Recognizing the interests of the manufacturers of brass and cast-iron fittings, a joint conference, appointed by these associations and your committee, was called, in order to harmonize all interests involved, and to adopt a resolution expressing the sense of such a meeting for the consideration of the Pipe Manufacturers' Association.

This conference was arranged on Monday, October 25, 1886, and was held at the Fifth Avenue Hotel, New York, at 11 o'clock A. M. of that date.

There were present at this conference: of the committee representing the Wrought-Iron Pipe Manufacturers' Association, Mr. J. H. Flagler, of the National Tube-Works Co.; Mr. L. W. Shallcross, chairman of the conference; of the committee appointed by the Cast-Iron Fittings Association, Mr. Carleton W. Nason, President of Nason Manufacturing Co., New York, representing also Mr. Jarecki, President of the Jarecki Manufacturing Co., Erie, Pa. There were also present, representing this association, Mr. W. H. Douglas, Corresponding Secretary. Also there were present, representing the Manufacturers' Association of Brass and Iron, Steam, Gas, and Water Work of the United States, Mr. S. L. Morison, secretary of the association. Of your committee there were present, Mr. William J. Baldwin and George M. Bond, secretary of the conference. Letters were read by Mr. Carleton W. Nason from Mr. R. T. Crane, Chicago, and Mr. C. C. Walworth, of Boston, members of their committee, who were unable to attend, stating their position in the matter. After considerable discussion the following resolution was unanimously carried:

"That it is the sense of this meeting that a common standard be adopted, and that action should proceed first from the pipe manufacturers, and for that reason we recommend that it should be particularly brought to their attention at the meeting to be held in Pittsburg this week."

The meeting of the Pipe Manufacturers' Association just referred to was held at the Monongahela House, Pittsburg, October 27, 1886.

The official notification received by your committee of the action taken by the pipe manufacturers at this meeting is here given:

"George M. Bond, Esq., Secretary Committee Standard Pipe and Pipe-Threads, American Society Mechanical Engineers, Hartford, Conn.

"DEAR SIR:—At a meeting of the Manufacturers of Wrought-Iron Pipe and Boiler Tubes in the United States, held at the Monongahela House, Pittsburg, October 27, 1886, it was resolved that the Wrought-Iron Pipe Manufacturers of the United States hereby adopt the Briggs standard of gauges, and that where any manufacturer has from any cause got away from that standard, they be requested to get such corrections made as soon as possible, so as to conform to the Briggs standard.

"Yours truly,
(Signed) "JAMES H. MURDOCK, Sec'y,
"Manufacturers Wrought-Iron Pipe and Boiler
"Tubes in the United States.
"Pittsburg, November 4, 1886."

Your committee has notified officially of the above action of the Pipe Manufacturers' Association, Mr. W. H. Douglas, Corresponding Secretary Cast-Iron Fittings Association, New York; Mr. S. L. Morison, Secretary Brass Fittings Association, New York, and Mr. John Maneely, Corresponding Secretary Malleable Iron Association, Philadelphia, in the following letter, which was mailed to each from Pittsburg, November, 4:

"It is gratifying to me to advise you that at a meeting of the Manufacturers of Wrought-Iron Pipe and Boiler Tubes in the United States, held at the Monongahela House, Pittsburg, October 27, 1886, it was resolved 'that the Wrought-Iron Pipe Manufacturers of the United States hereby adopt the Briggs standard of gauges, and that where any manufacturer has, from any cause, got away from that standard, they be requested to get such corrections as soon as possible, so as to conform to the Briggs standard.'

"Yours truly,
(Signed) "GEO. M. BOND, Sec'y,
"Committee Standard Pipe and Pipe Threads,
"American Society Mech. Engineers."

In concluding this report, your committee wish to express their appreciation of the assistance kindly rendered by Mr. J. H. Murdock, Secretary Manufacturers Wrought-Iron Pipe and Boiler Tubes in the United States; Mr. S. L. Morison, Secretary of the Association of Brass and Iron Fittings Manufacturers of the United States, and Mr. W. H. Douglas, Corresponding Secretary of the Cast-Iron Fittings Association, in furnishing lists of the different manufacturers of wrought-iron pipe, cast-iron, and brass fittings, and who in many ways greatly facilitated the work of your committee.

Respectfully submitted,
FREDERICK GRINNELL, Chairman.
GEO. M. BOND, Secretary.
GEORGE SCHUHMANN.
B. H. WARREN.
WM. J. BALDWIN.

New York, November 30, 1886.

ADDENDA.

The following communication, received subsequently to the presentation of the foregoing report, transmitting to your committee officially the resolution adopted by the Manufacturers' Association of Brass and Iron, Steam, Gas, and Water Work, sustaining the action of the Manufacturers of Wrought-Iron Pipe, is herewith presented:

"MANUFACTURERS' ASSOCIATION OF
"Brass and Iron, Steam, Gas, and Water Work
"79 FULTON ST., New York, Dec. 15, 1886.

"GEORGE M. BOND, Secretary Committee Standard Pipe and Pipe-Threads, American Society Mechanical Engineers, Care of Pratt & Whitney Co., Hartford, Conn.

"DEAR SIR:—At the meeting of the Manufacturers' Association of Brass and Iron, Steam, Gas, and Water Work, held at the Fifth Avenue Hotel, New York, on December 8, 1886, the following resolutions were unanimously adopted:

"That the action of the Wrought-Iron Pipe Association, in adopting the Briggs Standard as the Standard Iron Pipe Gauge of the United States, be indorsed, and that as Manufacturers of Brass and Iron, Steam, Gas, and Water Work we will act in conformity with the resolution adopted by them; and that as a measure of safety to ourselves, in order to avoid any difficulty with our customers at any time, that the Secretary of this Association be authorized to correspond with the Secretary of the Wrought-Iron Pipe, Cast-Iron Fittings and Malleable Fittings Associations, and, if acceptable to them, that an order be given by these Associations to the Pratt & Whitney Co., Hartford, Conn., for one set of Standard Gauges, and that such set of gauges be presented to the American Society of Mechanical Engineers as a matter of reference for all our united members, to be held by them in case of any dispute arising as to whether the members of these associations are manufacturing to the standard or not.

"*Resolved*, That the thanks of this Association are due to Mr. Bond for his enlightened, gentlemanly, and courteous manner in presenting this matter for our attention."

"Yours truly,
(Signed), "S. L. MORISON, *Secretary*."

For comprehensive information regarding the subject of standard pipe and pipe-threads, as applied in American practice, your committee would refer all who may be interested to the Minutes of the Proceedings of the Institution of Civil Engineers of Great Britain, Vol. LXXI., Session of 1882–1883, Part I., containing the paper of the late Robert Briggs, C. E.,* presented and read after his death, on "American Practice in Warming Buildings by Steam," which also includes the discussion which followed.

Referring especially to the subject your committee has had in hand, the following from the text and table of the paper of Mr. Briggs is here presented, giving completely the data upon which the Briggs standard pipe-thread sizes are based. * * *

"The taper employed for the conical tube ends is uniform with all makers of tubes or fittings—namely, an inclination of 1 in 32 to the axis. Custom has established also a particular length of screwed end for each different diameter of tube. Tubes of the several diameters are kept in stock by manufacturers and merchants, and form the basis of a regular trade in the apparatus for warming by steam. A knowledge of all these particulars is therefore essential for designing apparatus for the purpose. The ruling dimension in wrought-iron tube-work is the external diameter of certain nominal sizes, which are designated roughly according to their internal diameter. These nominal sizes were mainly established in the English tube trade between 1820 and 1840, and certain pitches of screw-thread were then adopted for them, the coarseness of the pitch varying roughly with the diameter, but in an arbitrary way utterly devoid of regularity. The length of the screwed portion on the tube end varies with the external diameter of the tube according to an arbitrary rule-of-thumb; whence results, for each size of tube, a certain minimum thickness of metal at the outer extremity of the tapering screwed tube-end. It is the determination of this minimum thickness of metal, for the tapering screwed end of a wrought-iron tube, which constitutes the question of mechanical interest.

"A longitudinal section of the tapering tube-end, with the screw-thread as actually formed, is shown full size in Fig. 105 for a nominal $2\frac{1}{2}$-inch tube—that is, a tube of about $2\frac{1}{2}$ inches internal diameter, and $2\frac{7}{8}$ inches actual external diameter.

"The thread employed has an angle of 60°; it is slightly rounded off both at the top and at the bottom, so that the height or depth of the thread, instead of being exactly equal to the pitch is only four-fifths of the pitch or equal to $0.8\,\frac{1}{n}$, if n be the number of threads per inch. For the length of tube-end throughout which the screw-thread continues perfect, the empirical formula used is $(0.8\,D + 4.8) \times \frac{1}{n}$, where D is the actual external diameter of the tube throughout its parallel length, and is expressed in inches. Further back, beyond the perfect threads, come two having the same taper at the bottom, but imperfect at the top. The remaining imperfect portion of the screw-

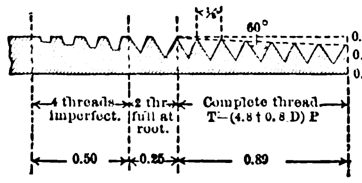


FIG. 105.—Thread of $2\frac{1}{2}$-inch tube. Full size.

thread, furthest back from the extremity of the tube, is not essential in any way to this system of joint; and its imperfection is simply incidental to the process of cutting the thread at a single operation. From the foregoing it follows that, at the very extremity of the tube, the diameter at the bottom of the thread,

$$D-\left[\frac{2\times(0.8\,D+4.8)}{32\,n}+\frac{2\times0.8}{n}\right]=D-(0.05\,D+1.9)\times\frac{1}{n}.$$

The thickness of iron below the bottom of the thread, at the tube extremity, is empirically taken to be $= 0.0175\,D + 0.025$. Hence the actual internal diameter d of any tube is found to be, in inches,

$$d = D-(0.05\,D+1.9)\times\frac{1}{n} - 2\times(0.0175\,D + 0.025),$$

or

$$d = 0.965\,D - 0.05\,\frac{D}{n} - \frac{1.9}{n} - 0.05.$$

For the various sizes of tubes, ranging from $\frac{1}{8}$ inch to 10 inches nominal internal diameter, with their corresponding numbers of screw-threads per inch, the actual internal diameter d is expressed by the following Table I. in terms of the actual external diameter D.

TABLE I.

DIAMETERS OF WROUGHT-IRON WELDED TUBES.

Nominal Internal Diameter of Tube.	Number of Screw-threads per inch.	Actual Internal Diameter d in Terms of Actual External Diameter D.
Inches.	*No.*	*Inches.*
1/8	27	$d = 0.9631\,D - 0.1204$
1/4 and 3/8	18	$d = 0.9622\,D - 0.1556$
1/2 and 3/4	14	$d = 0.9614\,D - 0.1857$
1, 1 1/4, 1 1/2 and 2	11 1/2	$d = 0.9607\,D - 0.2152$
2 1/2 to 10	8	$d = 0.9587\,D - 0.2875$

"The figures derived from this statement, which are of importance for practical use, are presented in detail in the accompanying Table II. in a convenient form for reference.

TABLE II.

STANDARD DIMENSIONS OF WROUGHT-IRON WELDED TUBES.

DIAMETER OF TUBE.			THICKNESS OF METAL.	SCREWED ENDS.	
Nominal Inside.	Actual Inside.	Actual Outside.		Number of Threads per Inch.	Length of Perfect Screw.
Inches.	Inches.	Inches.	Inches.	No.	Inch.
1/8	0.270	0.405	0.068	27	0.19
1/4	0.364	0.540	0.088	18	0.29
3/8	0.494	0.675	0.091	18	0.30
1/2	0.623	0.840	0.109	14	0.39
3/4	0.824	1.050	0.113	14	0.40
1	1.048	1.315	0.134	11 1/2	0.51
1 1/4	1.380	1.660	0.140	11 1/2	0.54
1 1/2	1.610	1.900	0.145	11 1/2	0.55
2	2.067	2.375	0.154	11 1/2	0.58
2 1/2	2.468	2.875	0.204	8	0.89
3	3.067	3.500	0.217	8	0.95
3 1/2	3.548	4.000	0.226	8	1.00
4	4.026	4.500	0.237	8	1.05
4 1/2	4.508	5.000	0.246	8	1.10
5	5.045	5.563	0.259	8	1.16
6	6.065	6.625	0.280	8	1.26
7	7.023	7.625	0.301	8	1.36
8	7.982	8.025	0.322	8	1.46
9	9.000	9.688	0.344	8	1.57
10	10.019	10.750	0.366	8	1.68

Taper of conical tube-ends, 1 in 32 to axis of tube.

"The number of screw-threads per inch for the several sizes of tubes is here accepted from customary usage. It is the workman's approximation to the pitch practically desirable, and much reluctance must consequently be felt

* Reprinted in abstract in THE SANITARY ENGINEER, Vol. VII.

in calling it in question. Still it would have been better to investigate the general case upon the basis of a pitch ranging in closer accordance with the range of tube diameter. Thus the nominal ½-inch tubes might have had 16 threads per inch; ¾-inch, 14 threads; 1 and 1¼ inch, 12 threads; 1½ and 2 inches, 11 threads; 2½ to 3½ inches, 10 threads; 4 to 6 inches, 8 threads; 7 to 9 inches, 7 threads; and 10 inches, not more than 6 threads per inch. The existing numbers of threads however, as given in Tables I. and II., are now too well established to be disturbed; at all events they must be taken in any statement of the present practice.

PHILADELPHIA ENGINEERS' CLUB.

AT the meeting of January 22, President T. M. Cleemann, in the chair, the Secretary presented, for Mr. Conway B. Hunt, a paper on "Hydraulic Dredging Machinery."

The paper mentions the early application of the principle of hydraulic dredging—that is, the mixing of dredged material with water and then removing the mixture by suction or otherwise; and after referring briefly to the Roy Stone and Bowers dredges as typical machines, describes in detail the Von Schmidt dredge. Two of these dredges are engaged on the improvement of the Potomac River at Washington, D. C., under the United States Government. Each is 100 feet by 50 feet, with a semi-circular bow, around which travels a vertical suction-pipe, 22 inches in diameter, and telescopic. At its foot is a conical hood, beneath which works a rotary excavating-plow 8 feet in diameter. The suction is produced by a powerful centrifugal pump, run by a 200-horse-power engine. The discharge-pipe is 20 inches in diameter, has rubber-hose joint connections and is carried to the shore on pontoons. The material was mixed with from 3 to 10 times its volume of water and discharged at distances up to 3,500 feet from the dredge, and at from 6 to 10 feet above water. A year's record shows an average of 175 cubic yards per working hour, and 2,300 yards per day, for each dredge. The work was done by contract, at prices of 12.37 cents, 15 cents, and 15.45 cents per cubic yard, which includes the cost of levees to confine the semi-fluid material, drains to carry off the water, etc. The final estimates were specified to be taken by cross-sections of the completed fill after it had become solidified and compacted. In conclusion, it is noted that the devices and details of hydraulic dredging-machines are the subjects of numerous patents, and their most efficient combination may be long deferred. The large number of machines that are still in the experimental stage of development would indicate that the best results attainable from this class of dredges have not yet been accomplished.

The secretary presented, for Mr. W. E. Hall, a paper on "Controlling Expansion in Locomotives."

Mr. E. S. Hutchinson described the Anderson process of water-purification on a large scale, as given by the inventor and as in use in several European cities. The water, after settling, is forced through a revolving purifier, which consists, essentially, of a wrought-iron cylinder, mounted on hollow trunnions, serving for inlet and outlet pipes. The curved ledges, running lengthwise of the cylinder on the inner surface, scoop up and shower down through the current of water fine borings of cast iron. By the combined motions of the cylinder and of the water-current, every portion of the water is brought into contact with the iron, the particles of which are kept constantly bright by friction against the sides of the cylinder, against each other, and the water.

He illustrated by a black-board sketch the general outline of the purifier and its connections, giving rate of revolution, velocity of flow of water, amount of iron required, cost of purification and of plant, and other results of some years' successful experience with the process.

The table of analyses which he gave showed that exceptionally bad and even dangerous drinking-waters were rendered not only innocuous but wholesome by this method, the organic impurities being for the major part removed, the hardness reduced 40 to 50 per cent., and a brilliant appearance imparted to them.

The Secretary had announced, in the notices for this meeting, that he had received from the New York Chamber of Commerce a few pamphlets upon the harbor of New York, with circulars inviting discussion of the proposed Government work on the harbor, and that they would be mailed, on application, to such members as are specially interested in river and harbor improvements, or desire to examine the documents with a view to possible discussion of the special questions involved in New York Harbor.

In compliance with the request embodied in the circular, Professor L. M. Haupt entered upon a discussion of the subject.

He said, with reference to the jetty plan proposed by the Board of U. S. Engineers, that he had previously given his comments in his papers entitled "Harbor Studies," which are now published in Vol. V., No. 4, of the Proceedings of the Club. There were a few statements, however, in the circular issued by the Chamber of Commerce to which he desired to call attention, since he believed that the plan proposed in said pamphlet was based upon a misconception of the intensity of the forces operating at the outlet of the East Channel.

In describing the forces available for the purpose of maintaining a channel by tidal currents, the author of the paper has divided them into two principal groups. One, composed of the waters passing through the Narrows; the other, of those from Raritan Bay and its adjacent drainage areas. The report then adds: "Both of these forces pass seaward between Sandy Hook and Coney Island, being divided by the Dry Romer Shoals, and it is estimated that the quantities of flood-tide waters are almost identical on either side of the shoal, while the ebb-tide waters are from ten to fifteen per cent. stronger over the east bank and through the channels north than through the channels on the south side of the shoal. It is probable that none of the waters that pass through the Narrows on the ebb tide ever flow south of this shoal, except at the seaward end of the bar, and under special conditions, such as high freshets, or the backing up of the waters by unusual winds."

If this statement were true, Sandy Hook would soon be cut down to a short spit, and the main ship-channel, instead of having over 67 feet in depth, would become subordinate to the East Channel. Moreover, were there no considerable stream of water flowing south of the west end of the East Channel, there could be no cause for the well-defined valley extending into Sandy Hook Bay. The form of the bottom is such as to contradict most emphatically this statement. There can be no doubt but that a large portion of the discharge passing through the Narrows impinges upon the New Jersey shore of Sandy Hook Bay, is then reflected along the the west side of the Hook, and thence deflected to the eastward through the main channel. At the mouth of the East Channel there is a bar at least two miles in length between the 30-foot curves, and having, according to the latest surveys, a least depth of 19.5 feet, requiring the removal of over 4,600,000 cubic yards. To remove this, there is a *surface* resultant of considerable power operating in the direction of the ebb tide, but which, according to Prof. Mitchell, does not extend to a depth of 12 feet, and consequently can have no material effect upon the bottom. At Gedney's Channel, on the contrary, the bar is but three-quarters of a mile in length, with a least depth of 23.3 feet, and containing only 760,000 cubic yards, whilst the resultant scouring forces extend to below 30 feet, at a point just inside of the entrance. All the reports agree in stating that the tidal forces in this channel exceed those of any other locality. Hence it is believed that notwithstanding the desirability of improving the shorter route *via* the East Channel, the cost and difficulties of such an undertaking by tidal scour would be so great as probably to render it impracticable, whilst the conditions at the head of Gedney's Channel are exceptionally favorable for such an improvement. Professor Haupt is an advocate of vertical deflectors, and the rest of his remarks was devoted to them.

Professor Haupt also submitted results of tests of the tensile strength of canvas, for the Reference-Book.

ST. LOUIS ENGINEERS' CLUB.

AT the meeting February 16, President Potter in the chair, the Executive Committee reported the doings of its meeting of the same date, recommending H. B. Gale, Otto Schmitz, and Arthur Thacher for election to membership. They were balloted for and elected. The following applications for membership were announced and referred to the Executive Committee: Alex. E. Abend, Charles F. Muller, Max G. Schinke, and Lewis Stockett.

The Secretary read a letter from Mary G. Smith, acknowledging receipt of the club's testimonial to the late C. Shaler Smith.

The Secretary also read a communication from John W. Weston, Commissioner-General for the United States for the Paris Railway Exposition and Jubilee, on the desirability of the club being represented in some way. The matter was referred to the Executive Committee.

Dr. Wellington Adams then read a paper on "The Design and Construction of Dynamo Electric Machinery," which was illustrated by diagrams and electrical apparatus. A number of formulæ were given, showing how the efficiency of any dynamo could be calculated. The paper was discussed by Messrs. Gale, Nipher, and Seddon.

The President announced the subject for the paper for the next meeting to be the "Present Aspects of the Problem of the Inter-Oceanic Ship transfer," by Robert Moore.

Adjourned.

RECENT WATER-WORKS CONSTRUCTION.

THE city of Boston has just completed and put in operation works for the supply of a small portion of one of its suburban districts which is situated above the level of the principal high-service works.

The city is now divided into three levels, the territory below elevations of sixty feet above high tide being supplied by gravity; elevations between 60 and 170 by the highland high-service works, and elevations between 170 and 330 from the new works just completed.

These works comprise a pumping-station, about 4,000 feet of force-main and a wrought-iron tank or reservoir situated on Bellevue Hill, which is the highest elevation within the city limits. From this reservoir the water is at present distributed through 12,000 feet of 12-inch, 8-inch and 6-inch pipes to about 40 families.

The pumping-station is a brick building, 20'8"x36'2" with an L 14'6"x16'2" for the storage of coal. The pumps are of the Knowles duplex pattern, with 10-inch steam cylinders, 7-inch water cylinders and 12-inch stroke. Steam is supplied by two upright tubular boilers, each 42-inches in diameter, and containing 85 2-inch tubes 6 feet in length. The pumps and boilers, with all piping and fittings, were furnished and erected by the Blake Manufacturing Co., of Boston, for $2,172. The engine-house and chimney were built by G. L. Eldridge, of Hyde Park, for $5,081. The reservoir or tank is 24 feet in diameter and 40 feet high, and contains when full about 125,000 gallons. The bottom is of plate-iron, $\frac{7}{16}$ of an inch thick. The sides of the tank are in ten courses of the following thicknesses: First and second courses, $\frac{7}{16}$ of an inch; third and fourth courses, ⅜ of an inch; fifth to tenth courses, $\frac{5}{16}$ of an inch. Vertical seams in the first four courses are double riveted; all other seams are single riveted, about two inches pitch. Rivets are ⅝ of an inch diameter. The tank was erected by E. Hodge & Co., of East Boston, for $2,700.

The tank rests on a foundation of hard pan, on which was laid sixteen inches of cement concrete. After the tank was placed in position, the small spaces between the bottom of the tank and the concrete foundation were filled with cement grout. The reservoir is to be enclosed and protected by a stone or brick building, designed to serve as a public observatory.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

AT the meeting of the American Society of Civil Engineers on February 16, briefly noticed in our last issue, a paper was read by William H. Grant, M. Am. Soc. C. E., on the "Calculation of the mean horse-power of a variable stream and the cost of replacing the power lost by a partial diversion of the flow." In this case the drainage area of the basin was thirty-three square miles, and that part above the site of the dam was thirteen miles. As no measurements could be taken as to the original flow, comparisons were made with other valleys similarly situated, and the quantity thus determined for each month of the year for twelve years. From this the available horse-power was determined, and on account of wide range the use of two turbine wheels of 125 and 45 horse-power determined upon as being required originally to utilize all the power. With these wheels supposed in use, taking the percentage of gate-opening required to vent the water on one or both, the final effective horse-power was obtained for each interval and summed up.

A similar operation with the water remaining in the stream determined the present effective horse-power. The *difference* had to be made up by subsidiary steam-power. Estimating cost and renewals, cost of operation, and capitalizing all, the excess of the sum of the last two when capitalized over the original, gave, according to the author, the proper measure of damage.

The discussion which followed led to the conclusion that, as the stream had never been utilized, the measure was rather the loss of *market value* by the diversion, and arose from the *commercial* and not the scientific side. Another criticism was that no stream of such dimensions would warrant the expense of two sizes of turbine, and that a greatly less power would be practically utilized than was claimed. As most large powers are assisted at times by steam, the water has value in so far as diminishes the coal bills.

In every case the *use* will in a measure govern the rate of damage; and where a large engine is required in any case the loss of five or ten per cent. of water-power does not increase by any means the total expenses by an equal percentage, as it means a little more coal only with no other additional expense.

Samples of *Teredo Navalis* were exhibited.

The death of William W. Wilson, of Yonkers, a member of seventeen years' standing, was announced.

REPAIRS OF SUSPENSION BRIDGE, WINDSOR LOCKS, CONN.*

As a matter of professional interest, and as an evidence of returning vigor and health to one whose works stand second to none in the annals of engineering, we reproduce from the *Troy Polytechnic* the following very interesting description of a troublesome and successful job.

The anchorage masonry of this bridge having given away soon after it was opened to travel, and the towers having commenced to lean beyond the point of safety, urgent and prompt measures became necessary to save the structure. As these were somewhat out of the line of ordinary bridge work, a brief account of them may be of interest to the readers of the *Polytechnic*.

The bridge has a centre span of 550 feet and two side spans of 300 feet each. It crosses the Connecticut River from the thriving little town of Windsor Locks to the village of Warehouse Point.

Where the cable enters the anchorage and changes its direction it is supported by a cast-iron saddle. The pressure upon this saddle is 100 tons, with an outward resultant. Owing to the defective anchorage masonry below the saddle it had given way under the pressure. When the masonry was crushed the saddle turned partly over and also moved forward, thereby elongating the cable curve and causing the towers to lean.

The ordinary method of remedying such a difficulty would be by direct lifts, but this method could not very well be applied, because the anchor-wall was too narrow to accommodate the necessary appliances. The anchorage was surrounded by water at most stages of the river, and furthermore the traffic on the bridge could not be interrupted while the work was going on.

In order to replace the defective stones by others of suitable strength the saddle had to be raised up and held, while the work of replacing the stones underneath was going on. As the pressure on this saddle was 100 tons it required apparatus of strength and somewhat novel construction to raise it. Part of the floor and truss of the bridge was first removed in front of the anchorage and four large piles driven in front of each anchor-wall of the east abutment, which were connected on top by oak caps and a platform, on which was placed a cast-iron pivot-plate. Next a wrought-iron box-girder thirty feet long, three feet high and two feet wide, was constructed. This was used as a lever. Its parts were proportioned to sustain a concentrated load of 100 tons at a distance of seven feet from the fulcrum end. One end of this lever rested on the pivot-plate on top of the piles, and under the land end were placed hydraulic jacks. The pressures were distributed as follows: pressure on the piles, 75 tons; pressure on the jacks, 25 tons; load to be lifted, 100 tons. The land end of the beam was placed 18 inches lower than the river end. At the start the saddle was connected with the beam by steel wire strands. Several hundred turns were passed through the holes in the saddle over the top of the beam. These strand-lashings were not vertical, but oblique to the rear, so that when the lifting action began the saddle was raised vertically and hauled back toward the land, at the same time thereby shortening the cables and pulling the towers toward a vertical position.

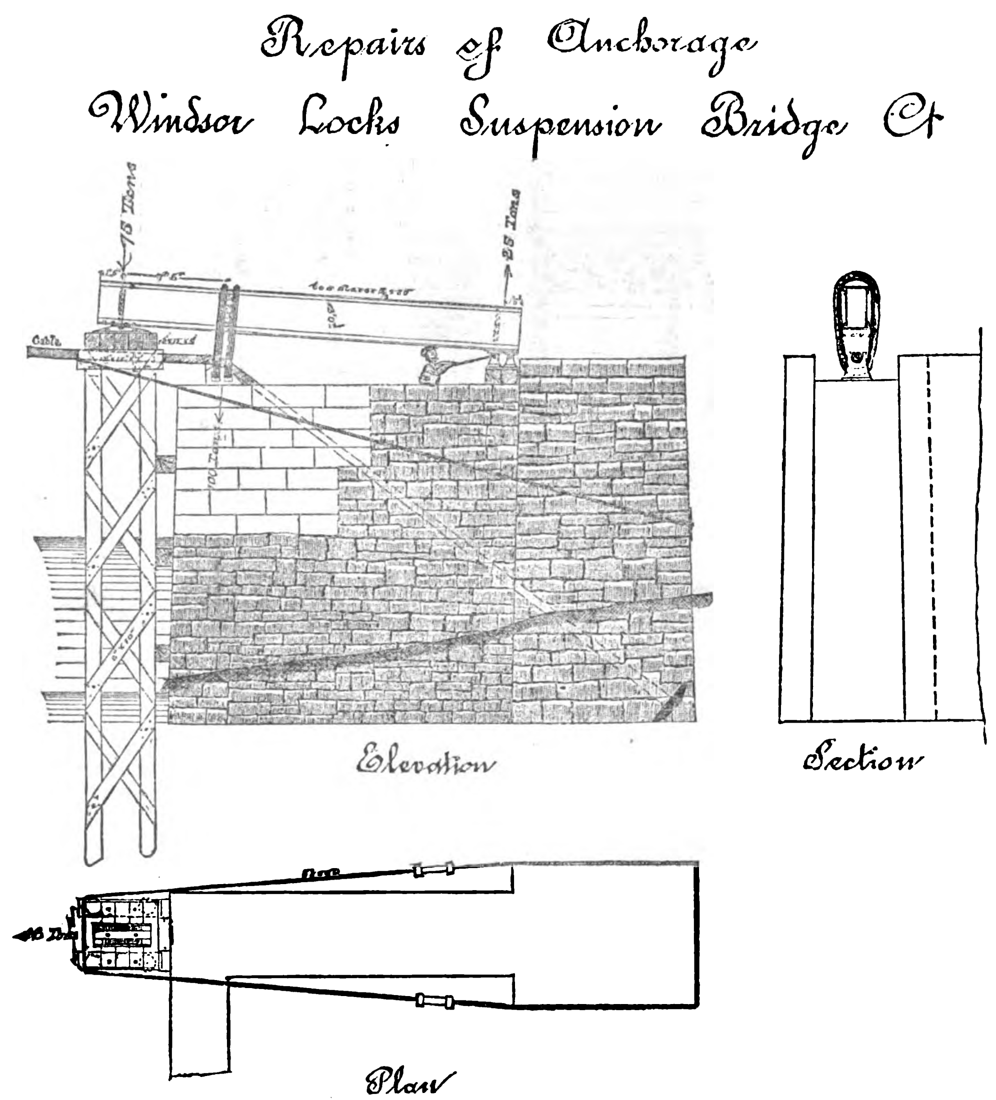
About half of the masonry covering the cable and the anchorage had to be removed to make room for the beam. This fact circumscribed the free motion of the back cable in raising. As the strand-lashings were inclined they caused an outward push of twenty tons on the piles, which had to be counteracted by bracing and passing wire-ropes around the piles and back of the anchorage.

When every part of a given operation has been properly proportioned and every strain provided for with a due margin of safety, the final operation is accomplished with little effort.

The end of the beam was lifted nearly three feet. This lifted the saddle six inches vertically, and moved it back three inches, some motion being lost through the stretching of strands and compression of timber.

The old masonry was then taken out underneath the saddle and as far back as was consistent with safety, and cut stone blocks, such as should have been used in the original construction, put in place. It has already been mentioned that the saddles had partly turned over sideways and had to be lifted in that position, and during the lifting they naturally tipped forward at right angles to the resultant. As it was impossible to level them sideways while suspended it had to be done as they were being lowered to their bed. It was also of the greatest importance to hold all the backward movement which had been gained in raising. As the saddle was lowered its movement would naturally be downward and forward, hence if lowered on a rigid surface the masonry joints would open and the edges spawl off.

After the masonry had been built up to the proper height, these difficulties were overcome in a very simple manner by introducing a cast-iron wedge-shaped sliding-block between the bottom of the saddle casting and the plate underneath. The upper surface of this block pitched forward parallel to the under face of the saddle. This wedge exactly fitted the space between the plate and the lowest edge of the casting. Both the under and upper surfaces of this wedge were thickly smeared with grease. As the saddle was lowered on this prepared surface it righted itself to a horizontal position, and at the same time the wedge slipped on the plate below and the saddle slid on the wedge, thus pre-



venting all forward strains on the masonry. The success of this operation can be judged by the fact that after the pressure had been transferred to the new masonry not even the smallest hair crack could be seen in the joints. The same operation was repeated on the other anchor-wall with the other cable.

This operation being complete an inspection of the towers showed they were still some eight inches out of plumb. To remedy this defect the unequal loading of the spans was the only resource left short of rebuilding the whole bridge. This was done by removing the greater portion of the oak planking from the centre span and replacing it with light chestnut. This change raised the main span over three feet and lowered the two land spans in proportion. The floor of the land-spans was then screwed up to grade by shortening the suspenders. In the main span the camber was reduced by lengthening out the suspenders.

This, of course, altered the form of the curve of the land cables very considerably. The lowest point of the land curve, instead of being at the face of the anchorage, was thrown thirty feet forward, and the cables touched the floor-beams for a distance of nearly forty feet from the anchorage out, caused by a close coincidence of its own curve, with the grade and local camber of the floor in the land span.

In connection with this subject it may be stated that the rectification of leaning towers by the unequal loading of spans can only be accomplished within narrow limits. In proportion as the land curve is lowered the position of its tangent changes rapidly toward the vertical, while the tangent of the main curve at the same time approaches the horizontal, thereby causing a horizontal component which tends to throw the tower back again toward the main span.

In this particular instance it was fortunately still possible to use this means without producing an ugly dishing in the floor of the land spans.

One of the peculiarities of this unequally-weighted bridge will be that when the cables contract in winter the land spans will not rise, but the main span will be lifted nearly twice as much as if it were properly balanced, and the towers will then lean slightly toward the land.

* W. A. Roebling, C. E., in the Troy Polytechnic.

RAPID TUNNEL-WORK.

A piece of rapid tunnel-work was done at Shaft 15 of the new Croton Aqueduct in January last. The tunnel section, 8x16 feet, gives 3¾ cubic yards per running foot, and through the portion then being penetrated was hard gneiss, and in one case pure quartz for fifteen feet; 614 lineal feet were driven in an average of 24¾ working days at two headings, or an average of 12.4 feet per heading per day. This was slightly greater at one heading and less at the other. Five Rand "slugger" drills, No. 13, were used, and it is stated that the same drills have been in use continuously for about two years. The number of shots fired was ninety-seven, Rendrock Powder Company's rackarock being used, except in a few centre cuts where dynamite was employed. Mr. William M. Hall is engineer in charge on Messrs. O'Brien & Clark's contract, and Mr. John Barron foreman at Shaft 15.

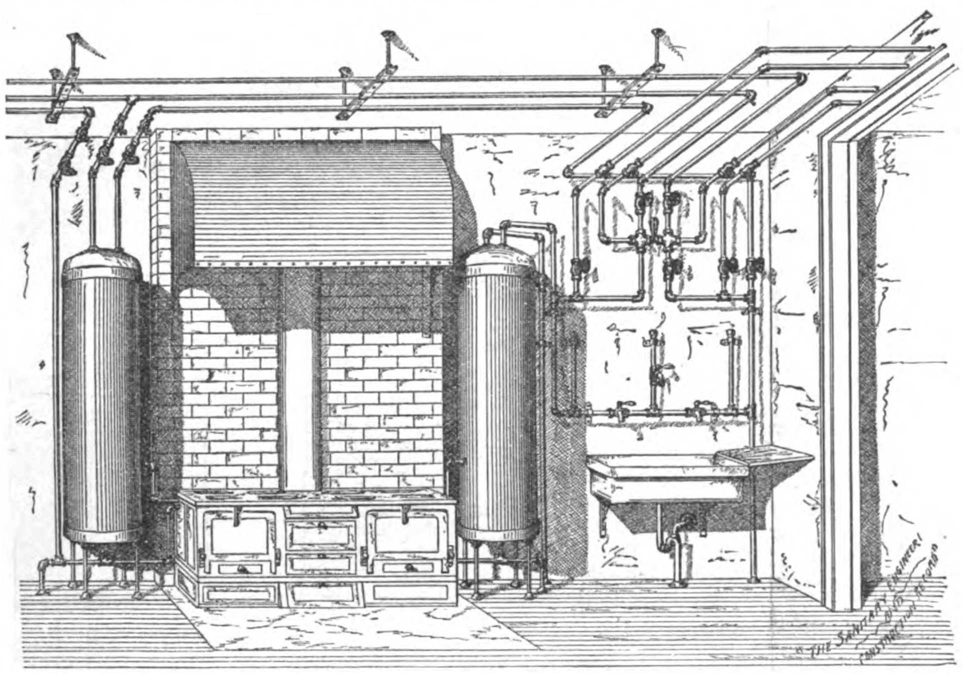
SAN FRANCISCO ARCHITECTS.

At a meeting of the San Francisco Chapter, February 4, the committee which had been appointed to confer with another committee of the Builders' Association to draw up a form of contract reported that a form had been drafted, and it was presented to the meeting for consideration. Mr. John Gash read a paper on "Plumbing," which was devoted to a discussion of the improvements made in the bath, closet, and sewers of the household, and the superiority of the modern over the ancient systems.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

KITCHEN-BOILERS IN RESIDENCE OF GEORGE VANDERBILT, ESQ.

OUR plumbing illustrations this week are from the residence of Mr. George Vanderbilt, 9 West Fifty-third Street, New York. Figure 1 shows the boilers in the kitchen, one on either side of the range. That on the right is supplied from the street-pressure, while that on the left receives its water from the tank on the top floor. The water-back was made specially for this work, and has a partition



through the centre allowing each boiler to be heated independently of the other. The water-pipes throughout are tinned brass, giving the work a very bright and pleasing appearance. Gate-valves are used in place of the ordinary stop-cocks, and reverse-cocks are placed directly over the kitchen-sink where they can be readily reached. Each boiler contains sixty gallons and is suppoited on specially made brass rims with four brass legs. The arrangement of the supply-pipes to the sink is very simple and neat, with air-chambers evenly spaced and a plug in the pipe to prevent the mingling of hot and cold water. The arrangement of the pipes will be evident on examination of the illustration, making further description unnecessary.

The master plumber was Mr. Alexander Orr, of New York.

(TO BE CONTINUED.)

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. VI.

(Continued from page 294.)

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

COLD-WATER SUPPLY-PIPES.

19. What is gained by putting a supply-pipe from street-main to house in a larger iron pipe?

The air in the iron pipe protects the supply; steam can also be inject ed around pipe in case of freezing.

20. How can water-supply be increased after service-pipe enters house?

Supply can be increased only by pumping, but its flow can be greatly assisted by using pipe of large calibre.

21. Is there any way to arrange a pipe so that drawing water from a lower floor will not stop or retard the flow from upper floors?

To proportion branch-pipes on different floors according to pressure; the less the pressure the larger the branch.

22. Suppose a three-story house had a five-eighth tap from main to house, and connected from this tap to top of boiler with a 1¼-inch pipe, what size should the branch-pipes to basement fixtures be?

From ½-inch to ¾-inch, according to head of water.

23. The parlor floor contains a pantry-sink, a wash-basin, and a water-closet: how large should the supply-pipe from basement to parlor floor be?

One-inch.

24. How large the branch-pipes to fixtures?

½-inch to ⅝-inch.

25. The second floor contains a bath, two water-closets, and five wash-basins: how large should the pipe from parlor to second floor be?

One-inch.

26. How large should the pipe from basement to tank be?

If for a pump, 1¼ to 1½ inch; if the supply is from tank it should diminish in size downward from 1½-inch to ½-inch or ⅝-inch.

27. In a building of six or more stories in height, with cold-water supply from tank on upper floor, does any difficulty occur?

On lower floors the pressure is excessive.

28. How can it be remedied?

By diminishing branches to give proportional supply, and having stop-cocks to regulate supply.

29. Can supply-pipe be so arranged that water can be drawn from the main or from tank?

Yes, by using a special or three-way cock made for that purpose.

30. What precautions should be taken to prevent pipes freezing?

Placing pipes where the least liability to freezing may occur, and also by boxing or felting.

31. Why are pipes liable to burst when they freeze?

When water is converted into ice it expands; the pipe consequently gives way under the expansion.

32. What is the expanding pressure of freezing water?

About 30,000 per square inch.

33. What means are taken to thaw out a service-pipe?

By application of heat externally, or by injecting steam or hot water; also, by salt.

34. Is the external application of heat objectionable with iron pipes?

In cast-iron there is some danger of the sudden expansion cracking the pipe.

35. In carrying supply-pipes across a floor what precaution can be taken to protect ceiling below from a leak?

By placing them in a box lined with lead and having a waste-pipe at lowest point.

36. Does fresh mortar injure lead pipes?

Yes, as the lime is corrosive and forming a compound with the lead which eventually destroys it.

(TO BE CONTINUED.)

MAJOR BERNARD O'REILLY, plumbing inspector in Milwaukee, has made his report. He claims he has inspected 1,208 houses and corrected 46 instances of negligent work. He found many places where the sewers were open, permitting the gases to escape. He also found joints not leaded and cemented, and connections so laid as to lead the impure air into the houses. He compels plumbers to put in fresh-air inlets and ventilate all traps under new fixtures and plans filed in his office, before work is begun.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

TRAP AND VALVE FOR CELLAR DRAINAGE.

THE accompanying Figs. 1, 2, and 3 represent a check-valve or ball for draining cellars and preventing a back flow from sewers. Fig. 1 is the detail of the valve in section. It is composed of the parts *a*, *b*, *c*, and *d*. The first being a brass ferrule that may be leaded into the iron hub of a pipe, as shown, or it may be soldered to a leaden pipe. Into the ferrule is secured the perforated cap *b*, which is both strainer and inverted seal for the ball *c*. The cage of wire *d* is simply to keep the ball from being carried through the pipe by the current, and allows it to return to its seal by its own buoyancy. The ferrule and strainer are set at such a level that the ball is always floated up against the seat.

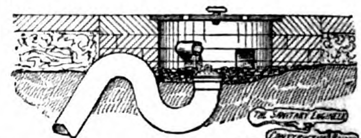


FIG. 3

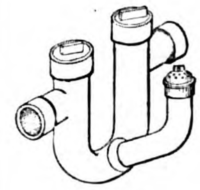


FIG. 2

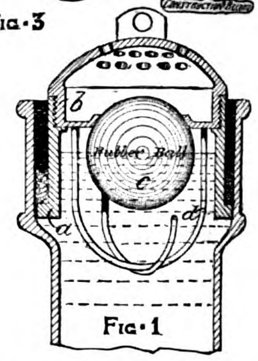


FIG. 1

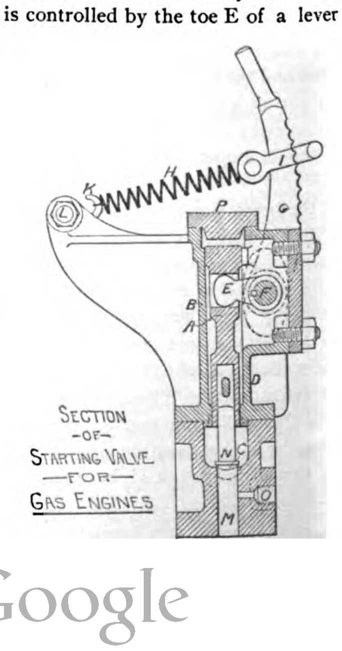
Figure 2 shows it as applied to the front wall-traps of a house. A quarter bend is used entering the dip of the trap and it is leaded into it. This, of course, is when the trap is in the floor or ground.

Figure 3 shows it when used on a separate trap as it might be in foundation drainage or cellar bottoms where it is required to drain loose rubble or broken stones beneath the concrete.

It was designed and is used by Mr. John Tucker, master plumber, of 40 McDougal Street, of New York.

STARTING-VALVE FOR GAS-ENGINES.

MR. J. ATKINSON, of London, recently patented a valve which has the double object of charging the starting reservoir by allowing some of the ignited contents of the cylinder to pass automatically into the reservoir at the time of the greatest pressure in the cylinder, and of starting the engine. The long spindle A slides within a cylindrical casing B, and the valve C is attached to the end of this spindle in such a manner that it can have a little end movement by being free from the spindle. The valve-stem works in a hole bored in the end of the spindle A, with its independent movement limited by the cotter C. The spindle A is controlled by the toe E of a lever working in



SECTION OF STARTING VALVE FOR GAS ENGINES

a slot formed in it, this lever being fixed on a small shaft F, which passes through a gland and has a handle-lever G. One end of a spring H is fixed to an attachment I, which may be moved along the handle-lever G into any of the notches on the lever. The other end of the spring is fixed to an attachment by which its tension may be adjusted. The tension of the spring may be caused to act at a greater or smaller leverage on the valve C by sliding the attachment up or down the lever G. The passage M is to the cylinder of the gas-engine, and the passage N leads to the starting-reservoir. O is a passage for attaching a pressure-indicator. To charge the reservoir, the attachment I is so placed that the high pressure in the engine cylinder at the time of ignition will lift up the valve C and allow some products of ignition to pass into the reservoir, where the maximum pressure is attained by lowering the attachment I, and the handle of the lever G may be lightly held back to allow the valve C to lift entirely free from the spring-pressure.—*The Gas Engineer.*

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

LEAD-BURNING.

TAUNTON, MASS, February 4, 1887.

SIR: I want to know something about the process of lead-burning, how the machine is made and how it is used. Have you anything in your line that will give me the information? If so please let me know. PIPER.

[Mr. Thomas H. Walker described an apparatus and methods for doing lead-burning in THE SANITARY ENGINEER AND CONSTRUCTION RECORD of April 5, 1883. The article gave rise to a controversy between Mr. Walker and Mr. C. E. Field, of John Street, New York. The articles and the discussions were illustrated, and went into the subject thoroughly. They are contained in Volumes VII. and VIII., which can be obtained from the Book Department; price, $3 per volume.]

DISCHARGE OF WASH-BOWL WASTE ON THE SURFACE OF THE GROUND.

WORCESTER, MASS., February 8, 1887.

SIR: Will you please give me your opinion on the following idea: In a house recently built the waste-pipes from bowls in chambers were taken to outside of house and emptied on top of the ground, instead of being connected with soil-pipe. In this case there was a sewer in the street, soil-pipe up through roof, and intercepting-trap, with fresh-air inlet between house and sewer.

Respectfully, "INQUIRER."

[We think it a nasty one, and can see no good reason for it. If much dirty water is discharged it will prove a nuisance.

PHILADELPHIA ENGINEERS' CLUB.

The club met February 5, President T. M. Cleemann in the chair. The secretary presented, for Mr. Morris P. Janney, a note upon the "Differential Gauge as Used at Blast-Furnaces," devised by Messrs. Taws & Hartman, engineers, Philadelphia, for the detection of irregularities in the working of blast-furnaces in the neighborhood of the tuyeres. At the instance of Mr. Janney attention was called to the recent discussion of the "Effect of Saccharine Matter on Mortars." Prof. L. M. Haupt noted the "Increased Weight of Locomotive-Engines as Affecting the Strains on Railway Bridges." Prof. Haupt also referred to two recent legislative matters of interest to engineers—the Wheeler bill for the examination of the earth's crust, and progress in the matter of rapid transit for Philadelphia.

SALICYLATED FOOD AND DRINKS.

A SPECIAL committee of the French Academy of Medicine has submitted, through Professor Vallin, a report on the use of salicylic acid and its compounds in alimentary substances, with reference to the dangers to health to be apprehended from such use.* Of late years salicylic acid and its compounds have been extensively used for the purpose of preventing the fermentation of articles of food or drink which are specially liable to this change, and therefore difficult of preservation or of transportation for long distances. It was first used for the preservation of wines of an inferior quality, then in beers, syrups, fruit-juices, meat, fish, etc.

The Central Committee of Hygiene of France has several times declared that foods and drinks which had been salicylated might be dangerous to health, and, as a result of this, in 1881, and again in 1883, the French Government prohibited the sale of such articles. Against this legislation numerous protests were made; physicians appeared to be divided in opinion, and some contradictory judicial decisions were rendered, so that the prohibitory legislation became practically a dead letter. Under these circumstances the Central Committee of Hygiene requested the opinion of the Academy of Medicine on the subject, which gave rise to the investigation resulting in the report above referred to. The report takes ground that while, in persons of good health, the prolonged use of such small quantities of salicylic acid as would be contained in articles of food or drink treated with this substance is probably not injurious to health, it may, nevertheless, produce very decided disorders of health in certain persons, and especially in the aged and in those who have a tendency to disease of the kidneys or to dyspepsia. Salicylic acid and its salts are eliminated from the system by the kidneys. They tend somewhat to check the action of the digestive ferments contained in the saliva, enteric juice, and pancreatic fluid, and hence to delay digestion; hence it is easy to understand that they may aggravate digestive or renal troubles. But while it is admitted on all hands that the unlimited addition of salicylic acid to food should not be permitted, it is claimed by those having commercial interests in the matter that a small quantity is without danger to health, while it is very valuable as a means of preservation. Such persons demand that the maximum amount of this substance which may be added shall be fixed by law—as, for example, from 123 to 154 grains to 26 gallons of wine, and 93 grains to 26 gallons of beer.

The commission made inquiry for itself as the proportion of salicylic acid which actually existed in beers and wines offered for sale, but without much success, for it would seem that the acid is decomposed into other products. It was concluded as the result of a number of analyses that the amount added to wine was about 10 grammes to the hectolitre (154 grains to 26 gallons), and to beer from 20 to 25 grammes to the hectolitre (308 to 385 grains to 26 gallons). The committee concluded that it would be very difficult to prove by chemical analysis the amount of salicylic acid actually added, and that it would be useless to attempt to fix a limit by law, while the fixation of toleration of such an adulteration would lead the immediate use of salicylic acid in a very large number of foods The commission, therefore recommended that the addition of salicylic acid or its compounds, even in small amounts, to articles of food or drink shall be absolutely prohibited by law.

* Bull. de l'Acad. de Med., Paris, 1886, T. XVI., 2me S. pp. 583 et seq.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
February 19...	24.10	19.55	20.88	29.19	28.89	21.01	32.42

E. G. LOVE, Ph.D., *Gas Examiner.*

ACCORDING to the report of the Chief Gas Examiner of London for the quarter ending December 31, 1886, the illuminating power of common coal-gas varied from 16.2 to 17.7 candles, while that of cannel-gas was 20.4 candles.

OUT of £13,422 spent for public lamps in London during the past year only £132 was for electric-lighting.

IN order to obtain a larger vertical angle of illumination from the arc electric-lights used for lighthouse purposes, Sir James Douglass has introduced a fluted carbon. This prevents the formation of a crater, and therefore gives a steadier and more uniformly distributed light.

THE President of the Board of Public Improvements of St. Louis proposes to solve the wire problem by placing the wires on iron towers from 100 feet to 150 feet in height, erected on arches at the intersection of the streets.

ACCORDING to *Industries* the Wenham Gas Lamp Co. are threatening to sue a number of manufacturers for infringement of their patent in adopting the same principle of regeneration and inverted flame.

THE thirteenth annual report of Dr. H. E. Armstrong, Medical Officer of Health, on the sanitary condition of Newcastle-on-the-Tyne for 1885, presents, in addition to the usual vital statistics for the year, a review of the mortality in Newcastle for the ten years, 1874–83, a report on the results of a house-to-house inspection, and a report on the domestic distribution of the water-supply of the city. The death-rate for the year 1885 was 26 per 1,000, an increase on that of the seven preceding years, due apparently to a considerable extent to an epidemic of measles which caused 359 deaths. Seventy cases of small-pox, 9 of typhus, 253 of enteric or typhoid fever, 1,277 cases of scarlet fever, 93 cases of diphtheria, and 11 cases of puerperal fever were known to the Health Department during the year. In a total of 1,130 infected houses the isolation adopted was reported as "fair" in 1.6 per cent., as "moderate" in 13 per cent., as imperfect in 43 per cent., while in 41 per cent. there was *no isolation at all.*

The results of the house-to-house inspection show, as is usual, that it was needed. The total number of inhabited houses reported on was 34,791 houses, and a large number of defects and nuisances were discovered, including over 2,000 unventilated soil-pipes, and 4,256 dwellings with defective water-supply. Upon this last subject Dr. Armstrong makes a special communication urging extension of and improvement in the facilities for obtaining water by the poorer classes.

A valuable series of statistical tables is given, and the whole report bears witness that it is the result of much labor and careful study of the conditions affecting the health of the city.

Patents.

354,217. Fire-Escape. Franz B. Peters, Lincoln, Neb. Filed July 23, 1886. Issued December 14, 1886.

354,224. Street-Clearing Machine. Isaac H. Randall, Boston, Mass. Filed February 19, 1886. Issued December 14, 1886.

354,238. Rain-Water Separator. Charles G. Roberts, Collards, Haslemere, County of Surrey, England. Filed June 7, 1886. Issued December 14, 1886. Patented in England February 16, 1883, No. 858, and September 16, 1885, No. 10,994.

355,658. Hydraulic Motor for Elevators and Other Purposes. Charles G. Otis, Brooklyn, N. Y. Filed September 24, 1886. Serial No. 214,456. Issued January 4, 1887.

355,665. Steam-Boiler. George H. Sutherland, Walla Walla, Wash. Filed November 13, 1886. Serial No. 218,780. Issued January 4, 1887.

10,793. (Reissue.) Regenerative Gas-Lamp. Charles M. Lungren, New York. Filed October 18, 1886. Serial No. 216,573. Original No. 347,622, dated August 17, 1886. Issued January 4, 1887.

355,626. Apparatus for Enriching Illuminating-Gas. Frederick B. Strunz, Pittsburg, Pa. Filed June 21, 1886. Serial No. 205,794. Issued January 4, 1887.

356,119. Pumping-Engine. Charles A. Hague, Hackensack N. J. Filed July 3, 1880. Serial No. 207,013. Issued January 18, 1887.

356,131. Steam-Boiler Filter. John W. Hyatt, Newark, N. J. Filed May 27, 1886. Serial No. 203,366. Issued January 18, 1887.

356,147. Hot-Air Engine. Benjamin F. McKinley, Cincinnati, O. Filed June 4, 1886. Serial No. 204,170. Issued January 18, 1887.

356,247. Apparatus for Generating Gas. Alphranzo A. Harwood, Scottdale, Pa. Filed June 2, 1880. Serial No. 203,921. Issued January 18, 1887.

PERSONAL.

DANIEL SPENCER died in Washington, D. C., February 16. For a number of years he had been in the employ of the Government as architect and supervisor of public buildings. He was a native of Castleton, N. Y.

MAJOR DAVID L. HUNTINGTON, Surgeon U. S. A., will be relieved from duty in the office of the Surgeon-General, March 1.

MAJOR CHARLES R. GREENLEAF, Surgeon U. S. A., is ordered to duty in the office of the Surgeon General. He is now on duty in Chicago.

COMMANDER CHARLES E. CLARK, U. S. N., has been designated Inspector of the newly created Ninth Lighthouse District.

A DIET OF IRON.

WASECA, MINN., Special, February 14.—An imported Holstein cow, worth $400, was found dead in her stall Wednesday, with her stomach full of tacks, nails, and pieces of iron, evidently from mill feed.—*Pioneer Press.*

A BILL has passed both branches of the Minnesota Legislature providing for the reorganization of the St. Paul Board of Health.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 14. PUBLISHED EVERY SATURDAY.

NEW YORK, MARCH 5, 1887.
LONDON, MARCH 19, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA.
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

HEATING RAILWAY-CARS.

THE New York State Railroad Commissioners last week made a report of a brief investigation made by them of methods of heating and lighting railroad-cars. Messrs. Kernan and Rogers make a majority report which substantially takes the ground that heating from a source outside the car has not yet been demonstrated as practicable, and that oil of 300° fire test is not dangerous when scattered over the contents of a wrecked car. In short, they make just such a report as might be expected from such railroad managers as want to avoid going to any expense to make any change at the present time. In the light of what is now known and what will be demonstrated over and over again during the present year, these two Commissioners will probably be ashamed of the position they have taken in their report before another twelvemonth.

Commissioner O'Donnell, on the other hand, in a minority report very properly upholds the system of heating from a source outside the car, and would prohibit the use of kerosene or any other inflammable oil.

The practicability of heating trains of cars by steam from the locomotive has been demonstrated to the satisfaction of any candid railroad man who does not want to avoid the necessary trouble of perfecting minor details that are always susceptible of improvement in any department of mechanical engineering. Such improvements, however, can only be suggested by actual and extensive use. To that extent railroad managers are bound to experiment, and the fact that systems of heating cars are not absolutely perfect is no reason at all for not adopting them as they are and improving the details as occasion makes practicable—such as always has been done with all improvements in railway rolling stock. Elsewhere in this issue will be found an illustrated article giving a résumé of what has been done in this direction in the past and the state of the art at this time. From this it will be seen that there is ample justification for prompt legislation forbidding after January 1 a continuance of the present methods of heating and lighting cars.

THE KILL VON KULL BRIDGE.

WE notice in the New York *Tribune* that the Senate Committee on Commerce, by a unanimous vote, agreed to an adverse report on the McPherson Bill, which it is alleged is based upon the report of the Board of Engineers condemning the proposed Kill von Kull Bridge, authorized by a former Congress, which bridge would seriously interfere with the commerce of this important waterway, as we pointed out in the issues of THE SANITARY ENGINEER AND CONSTRUCTION RECORD of January 15 and February 5 and 12. There may be good reasons for dissenting from the McPherson Bill, but we do not at all agree with the plea of the railroad people that now the Secretary of War has no excuse for withholding his approval of the plans submitted to him in accordance with the former faulty bill. We have no doubt that the *Tribune* is correct when it says: "The money to build the bridge has been ready some months. The land has been purchased, and only four miles of construction are necessary to bring the whole railway system of the South and West into connection with ten miles of water-front in the harbor of New York."

It may be desirable to bring this railway system to the water-front in the harbor of New York, yet it is vastly more important that it should be brought there without crippling the enormous commerce of a waterway which is nearly equal to that of the city of London on the Thames, which the erection of this bridge as proposed will certainly do. These railroad people should be either compelled to build a tunnel or so construct a bridge that the commerce of the Kill von Kull shall not be interfered with. We hope the Secretary of War will *withhold his approval* and be governed by the advice of his disinterested engineer advisers rather than by the importunities of railroad lobbyists. If the securing of an outlet for this railroad system is not worth paying for a properly constructed tunnel from Staten Island to New Jersey, then we had better wait for the outlet.

THE GERMAN COMMISSION ON VACCINATION.

BY vote of the German Parliament a commission was created in 1883 to consider and report upon the objections to vaccination and anti-vaccination. This commission was a large one, and included three prominent opponents of vaccination. The following are some of the conclusions given in its report as stated in the *Annales a'Hygiene Publique* for February, 1887:

The length of time for which vaccination protects against small-pox varies greatly in different persons, but in the mean it is about ten years. Revaccination is necessary ten years after the primary operation. Two well-marked vesicles are necessary to insure a successful protective vaccination.

There is no evidence as to any increase of special diseases or of general mortality which can be considered as due to the introduction of vaccination.

The use of animal vaccine is preferable. Vaccination should not be performed while scarlet fever, measles, diphtheria, whooping-cough, typhus, or erysipelas are epidemic or unusually prevalent in the neighborhood. Infants should not be vaccinated before they are three months old, unless small-pox is prevalent in the vicinity.

The greatest care as to the cleanliness and disinfection of the instruments used for vaccinating is insisted on.

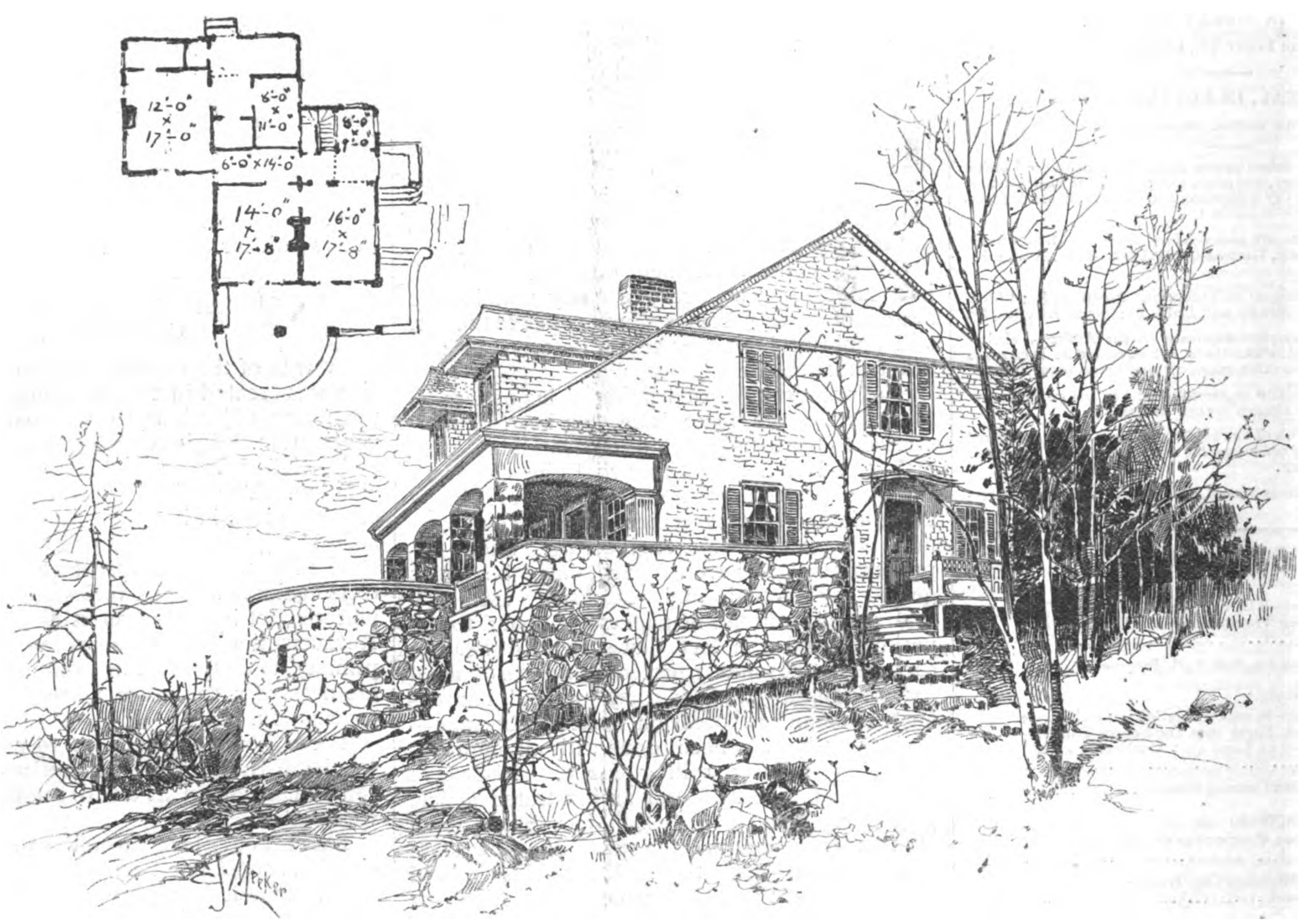
MR. CURTIN, of Philadelphia, has introduced in Congress a bill, elsewhere printed, to provide for the erection of a memorial bridge to General Grant over the Potomac River from Washington to Arlington. The idea of a memorial bridge, we believe, is that of Captain T. N. Symons, Corps of Engineers, U. S. A., who has worked up the preliminary designs of the bridge, the architectural features of which are by Messrs. Smithmeyer & Pelz, of Washington. From press dispatches it would seem that the various Senators and Representatives think favorably of Captain Symons' idea, and though it may be rather late for this Congress to take favorable action, we should be glad to see some such scheme authorized by a future Congress.

Captain Symons, in a letter to the New York *Herald*, hopes that the bridge if its construction be authorized, will be sufficiently completed for travel in time for the centennial celebration in 1889, but the entire structure will probably take a number of years.

We are having a drawing made from illustrations received from Captain Symons, which we hope to give our readers in an early issue.

A NEW SUBWAY COMMISSION FOR NEW YORK PROPOSED.

A BILL has been prepared by Corporation Counsel Lacombe, of this city, which has the approval of Mayor Hewitt and Public Works Commissioner Newton, abolishing the present Board of Subway Commissioners, and puts the matter of burying the wires under the control of the Board of Estimate and Apportionment and the Commissioner of Public Works, to be constituted a "Board of Subway Construction and Control for the city of New York." The present Subway Commissioners are, within ten days after the passage of the act, to turn over to this board all maps, plans, models, books, papers, and data relating to the construction and location of electrical conductors, conduits or subways which have been filed or communicated to them.



A RESIDENCE AT MANCHESTER, MASS.—E. M. WHEELWRIGHT, ARCHITECT.

The new board is to have power to cause the removal of wires and to adopt and carry out the necessary plans and measures for the building of conduits and the placing of wires within them; also, for the employment of experts. Plans adopted by the board shall be executed by the Commissioner of Public Works under contract.

It also confers power on the board to acquire by purchase at private sale any conduits or subways already constructed under the authority of the present Board of Subway Commissioners, and also any patent rights or the exclusive right to use in the city of New York any patented thing if the board shall deem it necessary to do so.

All work in relation to opening, occupation, or repavement of streets hereafter to be under the sole control of this board.

The board also have power to fix a scale of rents, and modify or change them from time to time as they may deem necessary, or to lease space in the conduits or subways to any person or corporation authorized to operate electrical conductors. All the rentals to be collected by the Controller, the board having the power to provide means to enforce the payments of rents even to the extent of interrupting the use of the wires in the case of unnecessary delay in the payments. All rents to be appropriated first to the payment of the expense of maintenance, custody, and repair of the conduits or subways; second, the balance to be turned into the general fund and applied to the reduction of taxation.

OUR BRITISH CORRESPONDENCE.

Fires in London in 1886—Sewage Irrigation on Small Areas—Utilizing Water that flows into the Severn Tunnel—Making a Sewage Farm on Land Consisting of Stiff Clay.

LONDON, February 16, 1887.

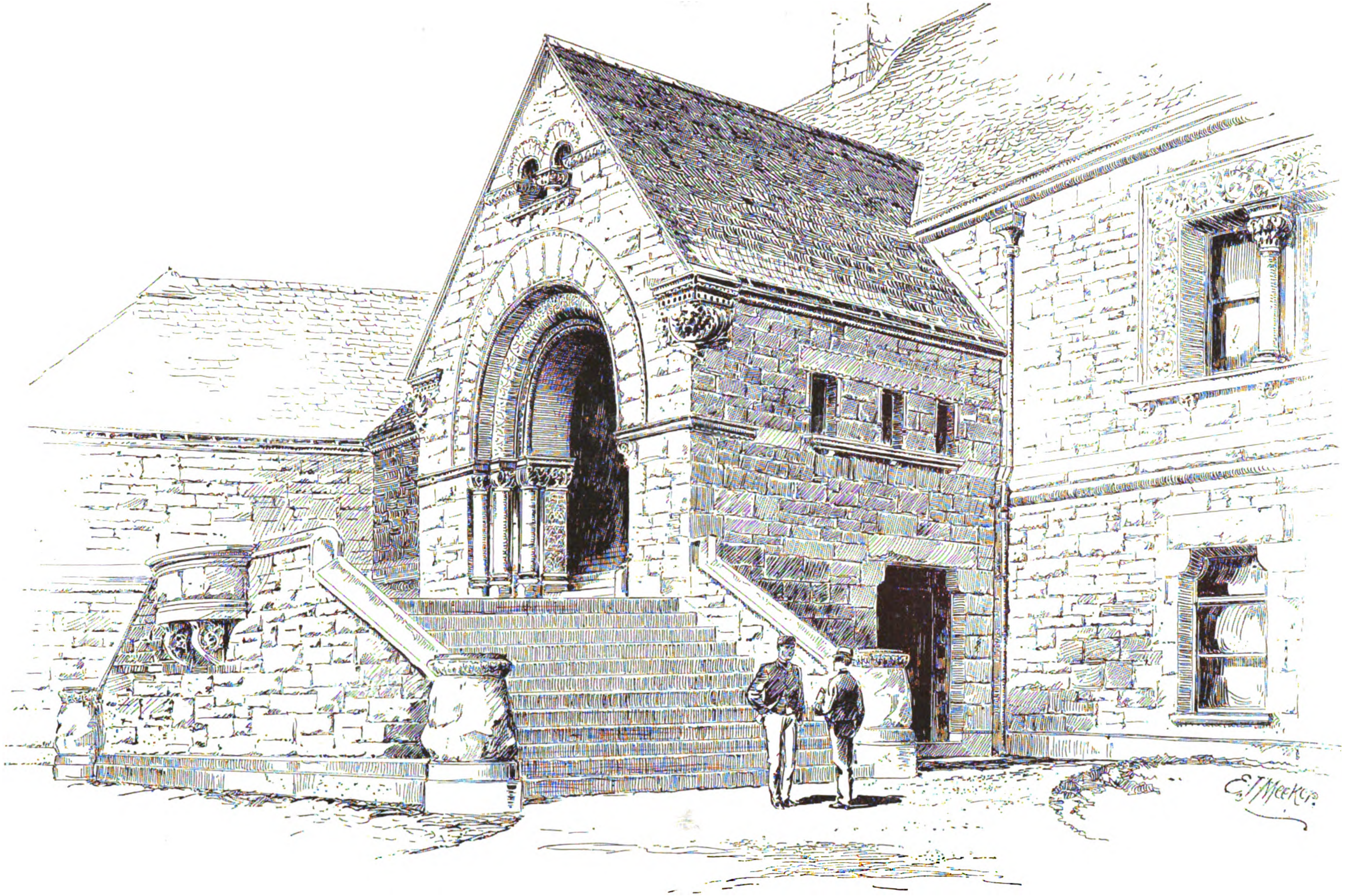
THE number of fires in London during 1886 was considerably below that in 1885. The year, however, witnessed some great fires, the most serious being that at the Isle of Dogs, where thousands of gallons of paraffine oil blazed for hours, the recent Knightrider Street fire, and the outbreak at King's Cross, where a train on the Underground Railway narrowly escaped crushing by falling ruins. During the year progress has been made in the adoption of a fire-alarm circuit system, and many outlying districts have now direct and immediate communication with fire-stations, where they were before isolated. The system is thought to work well, although the number of false alarms is largely augmented, and the light of a fire causes many people to ring an alarm under the impression that the fire is near at hand. The entire staff of the brigade is 680 men, which includes the chief and second officers—Captain Shaw and Mr. Simonds; the four superintendents—Messrs. Palmer, Hamlyn, Campbell, and Hutchings—as well as engineers and firemen. The brigade has 59 stations in different parts of the metropolis, with 46 steamers, 124 manuals, as well as 154 escapes, long ladders, telescope-ladders, and escape-ladders.

In a paper recently read before the Association of Public Sanitary Inspectors on "Sewage Irrigation applied to small areas," Mr. James Bateman, of Pewsey, Wilts., held that a properly carried out irrigation scheme was highly beneficial. He specially advocated such course of disposal in the case of villages having a population of 2,000 to 3,000 people, with no urban authority. Taking a hypothetical case of a village with a daily flow of 105,000 gallons, he said that an outfall-sewer 1'6"x2'3" should lead to deposit-tanks in connection with an irrigation area. Subsoil drainage should be provided, and the irrigation area should be in duplicate, for alternate working of the parts, only sufficient land being necessary to take the daily quantity of sewage of the place. The sewage should be allowed to settle in the tanks for twenty-four hours before being discharged on to the land. He estimated the cost at about £1 ($4.80) per head of the population. One paragraph, at least, in his paper will be open to question, where he says the tanks need not be covered, as no nuisance would arise from exposure of the contents to the atmosphere.

The Bristol Corporation has determined to utilize the waste-water pumped by the Great Western Railway Company from the Sudbrook Springs on the west side of the Severn Tunnel, to prevent flooding of the tunnel. The pumping operations entail an expense upon the railway company of some £10,000 ($48,000) per annum, and the water has hitherto been pumped into the River Severn. Analysts certify the water as being the purest spring-water, absolutely fit in every respect for domestic use. The corporation will, of course, effect considerable saving, as compared with the expense which would be incurred by pumping for themselves, but it is proposed by them to make arrangements with the railway company on reciprocally advantageous terms.

An extraordinary experiment is reported from a small village near Nottingham. An area of some fifteen acres is being laid out as a sewage-farm to accommodate a population of some 4,000 persons. The land is composed of very stiff clay, and this is being lightened by the admixture of ashes. It is hoped by Mr. Radford, the Engineer of Nottingham, that he can demonstrate the adaptability of a clay soil for such purpose.

SAFETY-VALVE.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

ENTRANCE TO MEMORIAL HALL, LAWRENCEVILLE SCHOOL, LAWRENCEVILLE, N. J.

PEABODY & STEARNS, ARCHITECTS.


yellow tint
white plaster panel.
mahogany doors.
3'-11½"
8'4"
10¼"
2½"
Sketched for "The Sanitary Engineer and Construction Record".
F. E. Wallis.
Drawing R'm door
"KENMORE"
Fredericksburg Va.
Date about 1740.


Dining Room door
"Chase House"
Annapolis Md.
date 1770.
"Sketched for The Sanitary Engineer and Construction Record"
F. E. Wallis.

ENGINEERING & ARCHITECTURE

OUR SPECIAL ILLUSTRATION.

ENTRANCE TO MEMORIAL HALL, LAWRENCEVILLE SCHOOL, LAWRENCEVILLE, N. J.—PEABODY & STEARNS, ARCH'TS.

THE subject of our special illustration this week is the entrance to Memorial Hall, Lawrenceville School, at Lawrenceville, N. J., other illustrations of which appeared in our issue of December 4, 1886.

Peabody & Stearns were the architects.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A RESIDENCE AT MANCHESTER, MASS.—E. M. WHEELWRIGHT, ARCHITECT.

THE subject of our vignette illustration this week is the residence of Mr. J. Murray Howe, at Manchester, Mass. It is of wood, the interior being pine, painted; cost, $4,500. The architect was E. M. Wheelwright, of Boston.

OLD COLONIAL DETAIL SERIES.

OUR page of old colonial details this week illustrates two doorways, that of Annapolis, Md., showing the dining-room door of the Chase House. One will notice the decided French feeling shown in the moldings and carving, which is quite noticeable in and about Annapolis. The doorway at Fredericksburg is from the house erected by the brother-in-law of General Washington. The walls are tinted yellow, showing the plaster panel in relief over arch in white. The woodwork in both cases is painted white.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XIII.

(Continued from page 291.)

RAISING THE OLD U. S. COURT-HOUSE IN BOSTON.

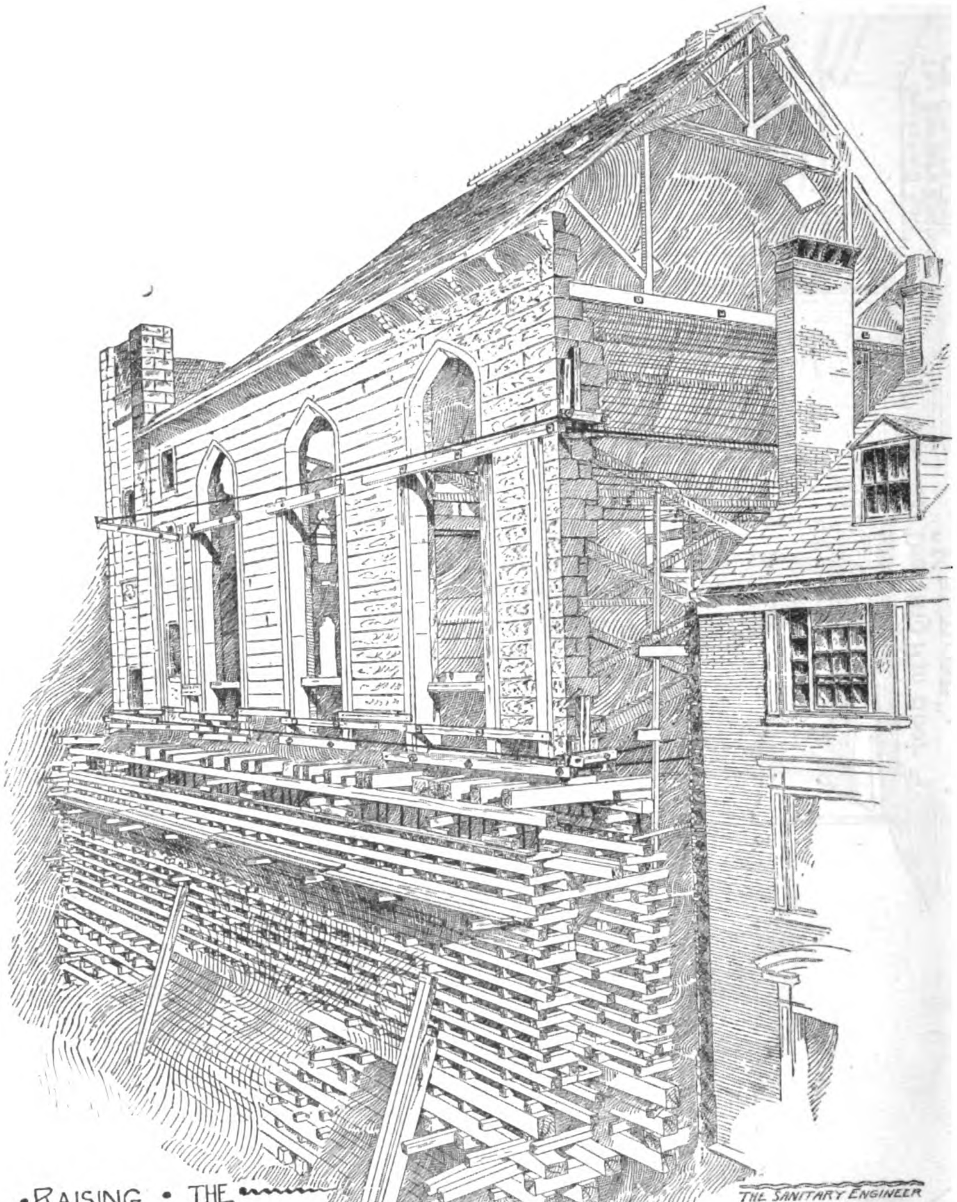
THIS building was originally the old Masonic Temple, built in 1832, in rather heavy Gothic style, a view of it in outline being given in Fig. 50. It was 60x80 feet in plan, with a heavy tower 16 feet square and 95 feet high at each angle of the Tremont Street front; was five stories, and was lighted by long arched windows on the sides. The walls were of granite, 22 inches thick on the average, and the weight to be raised, as hereinafter described, was estimated at nearly 1,500 tons.

After serving as a court-house until the court was removed to the Post-Office block, the building was sold, and the new owners desired to fit it up for business purposes. The 80-feet front was on Temple Place, which had been widened several years before, so that the building projected three feet over the new street-line. At that time the owners charged so high a price for damages that the city declined to pay the sum. The present owners, therefore, feared that should they demolish the building they would be obliged by the city to adopt the new line, and, in order to save the 240 feet of ground-space, they adopted the expedient of raising the old building and inserting girders underneath and iron columns for the store fronts. The line separating the part raised from that removed is indicated in Fig. 50, the raised portion being about 36 feet high.

The contractor for the work was Mr. Isaac Blair. The original design was to cut down the towers to the level of the roof, remove the interior work, and raise the exterior walls and towers intact.

After beginning the work, however, the contractor decided that as the rear wall (A, see small plan) had to be removed to take in an alleyway at the rear, and as the interior portion B C of the towers had a comparatively slight bond with the exterior, these might better be removed.

This resulted in dividing the building virtually into two halves, since the window at the front ran nearly to the peak; and it was noticed as the work progressed that any inequalities in raising of the two sides was indicated by opening and closing of the joint at the key of the arch above this window. It will be noted, also, that the side walls were divided into nearly separate portions by the long windows in them. To insure the stability of the whole, long timbers (M, see sketch Fig. 50) were braced from wall to



RAISING THE OLD COURT HOUSE BOSTON, MASS. FIG. 51

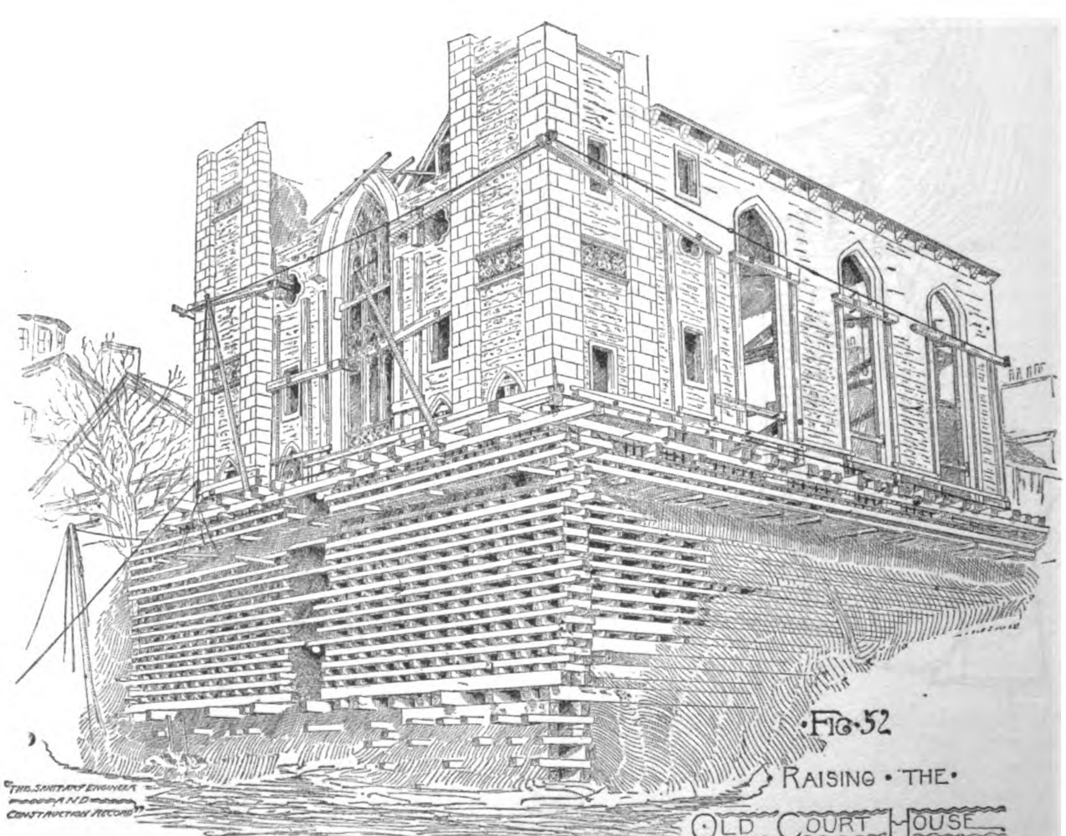


FIG. 52 RAISING THE OLD COURT HOUSE BOSTON, MASS.

wall with diagonals (N) in a vertical plane between them. The diagonals were bolted at their intersection. Timbers were placed across each opening at top and bottom, both inside and outside, and strongly bolted together. These served also to support the ends of the diagonals and interior braces. Binding timbers were also placed each side of the openings, both inside and outside. Heavy tie-rods in pairs at top and bottom of the openings served to tie the walls lengthwise, and similar rods were also run across the building. The general arrangement is shown in Fig. 51.

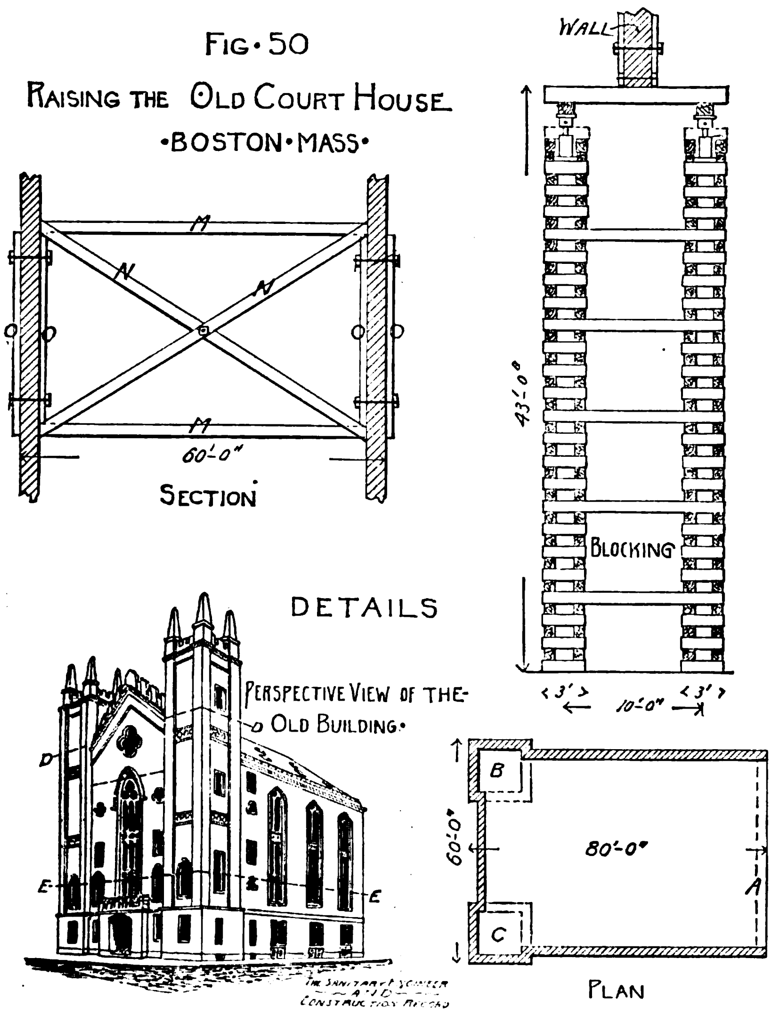
When this was all ready the walls were pierced for "needles" at *about* 3-foot centres, according to the load to be borne. These were 14x14-inch hard pine, and were supported on two ranges of blocking, which were spaced at about 10 feet on centres. To prepare for this, excavations were made on each side of the foundation, so that at the start the cribs were 28 feet high, and at the close they were 43 feet high.

The cribs were built up of 6x8-inch timbers and were each about 3 feet thick; at intervals of about 5 feet vertically, lines of timbers were carried across the space between to stiffen and bind the whole (see sketch Fig. 50). Several

FIG·50

RAISING THE OLD COURT HOUSE

·BOSTON·MASS·



timbers were also carried through the blocking, across the building, and butted against the side walls of the adjacent building. There were also exterior shores, as seen in Fig. 51. An opening for the passage of carts was left through the cribbing at the front, and others at the side for carrying in material of various kinds. The "needles" rested directly upon longitudinals 14x14 inches in lengths of 40 to 60 feet, against which the upper ends of the lifting screws took their bearing. The screws were 18 inches long and had a lift of 14 inches each; and as there were 300 in use, they were estimated to have a load of four to five tons each. Under the towers they were but 12 inches apart. They rested on 3-inch plank crossing the cribs, and were worked by six men, one on each side of each of the three walls turning each screw consecutively a definite amount. These were followed by a gang of men, who, as soon as the screws were out their full length, inserted new blocking. The job was eminently successful, and not the slightest accident occurred throughout. The cost also was very low, being about $3,500. The work of refitting was, of course, in addition to this.

Some notices of interesting work done in Milwaukee of a similar character to that just described, by M. Henry Buestrin, have recently appeared. In one case a malt-house had 1,700 screws placed under it, and one corner was raised seven feet, and a diagonal corner two feet, so as to make it plumb. A chimney-stack 120 feet high and eight feet square was safely moved over half a block. He also raised an elevator several feet. Other difficult jobs are mentioned, and we hope to give illustrations of one or more difficult ones now in progress.

(To be continued.)

MODERN SEWER CONSTRUCTION AND SEWAGE DISPOSAL.

BY EDWARD S. PHILBRICK, MEM. AM. SOC. C. E.

No. IV.

Continued from page 236.)

THE general feeling of dissatisfaction with their sanitary condition among the citizens of Boston led, in March, 1875, to the appointment by the Mayor of a commission to examine the case thoroughly and devise a remedy. This commission consisted of E. S. Chesbrough, C. E., Moses Lane, C. E., and Charles F. Folsom, M. D., who reported in December, 1875. The following summary is quoted from their report, p. 15:

"The evils which exist in our system of sewerage in Boston chiefly arise from additions being constantly made to the territory of the city, and from the sewers being necessarily extended through these low districts, and on very flat grades, without a definite comprehensive system."

"The point which must be attended to, if we would get increased comforts and luxuries in our houses, without doing so at the cost of health and life, is to get our refuse out of the way, far beyond any possibility of harm, before it becomes dangerous from putrefaction. In the heat of summer this time should not exceed twelve hours. We fail to do this now in three ways:

"*First*—We cannot get our refuse always from our house-drains to our sewers, because the latter may not only be full themselves at high tide, but they may even force the sewage up our drains into our houses.

"*Second*—We do not empty our sewers promptly, because the tide or the tide-gates prevent it. In such case, the sewage being stagnant, a precipitate falls to the bottom, which the slow and gradual emptying of the sewers, as the tide falls, does not produce scour enough to remove. This deposit remains with little change in some places for many months.

"*Third*—With our refuse, which is of an especially foul character, once at the outlets of the sewers, it is again delayed there to decompose and contaminate the air.

"As a result of this failure to carry out the cardinal rule of sewerage, we are obliged to neglect the second rule, which is nearly as important—viz., ventilation of the sewers; for the gases are often so foul that we cannot allow them to escape without creating a nuisance, and we compromise the matter by closing all the vents we can, with a certainty of poisoning the air of our houses.

"The sewage should start from the houses and go in a continuous current without stopping until it reaches its destination, either in deep water or upon the land. In such case the sewers will contain no offensive gases, and free ventilation can take place with a few simple precautions."

The remedy proposed by this commission consisted in building intercepting sewers around the whole peninsula and around South Boston Point also. These were to receive and collect at one point the sewage then flowing from upwards of sixty separate mouths, around the margin of the city proper, with further extensive works that were to convey it, after being thus collected, to a suitable place. Such a place had been found, in the opinion of the commission, which subsequent events have proved to have been well chosen. It was at the outer extremity of a small island on the south side of the harbor, called Moon Island, past which point the ebb tide was found to run with a deep, strong current.

It was recommended to store the sewage temporarily between tides in reservoirs on Moon Island, and to discharge it into this tidal current during the first few hours of each ebb tide.

This current would carry the sewage so far out to sea that its dilution would become incalculable before the next flood tide should set it back toward the harbor. Such a scheme was estimated to cost nearly four millions of dollars, and was not undertaken till after a long discussion and a good deal of opposition from citizens who were either not convinced of the need of immediate action or doubted the feasibility of the scheme. It was urged by such men that the cost would far exceed the estimates, and that the results would not meet the expectations of those who favored the plan. But none of these objectors brought forward any reasonable alternative for relieving the city of existing evils, which were too well known to be covered up.

The most specious arguments against the scheme of disposal came from those who believed in the value of sewage as a manure and advised its application to the land where such value could be availed of. It was called a sinful waste to consign so much organic matter to the ocean, and thereby ignore the advice of those celebrated modern chemists who had taught us its use as plant-food. Theoretically this sewage contained nitrogenous matter enough to render fertile hundreds of acres of waste and barren land in the neighborhood of the city that was now lying idle and producing nothing. But the commissioners, who had spent several months in the examination of the subject, had not overlooked this subject. We find in the appendix of their report a description of the methods adopted to dispose of the sewage in fifteen modern European towns, in many of which costly experiments had been tried with the view to utilize sewage on the land. They report that in London "all of the sewage goes into the Thames, except that corresponding to a population of 20,000, which is utilized at some pecuniary loss, on an experimental sewage-farm at Barking." At Liverpool, "a few years ago the sewage was carried to a point north of the city and delivered by pumps upon a farm for irrigation, but the whole process was found so costly that it had to be abandoned."

At Paris they say that "the irrigation with sewage is, unfortunately, at present carried out on a very small scale and at considerable pecuniary loss to the city, although the farmers, who pay nothing for the sewage, make some profit." Some further inquiries made by the writer developed the fact that the farmers who take the Paris sewage at Gennevilliers take it only at their own option, rejecting it whenever its use on the land would be injurious to the crops. It is evident that such a method of disposal as this could not be relied on by any community for a general plan, and only offers partial and occasional relief at best.

It was for reasons based on such experience as above quoted that the commission who had the sewerage of Boston under consideration recommended what they did. They state that the method "adopted the world over by large cities near deep water consisted in carrying the sewage out so far that its point of discharge will be remote from dwellings, beyond the possibility of doing harm."

In short, the disposal of sewage by irrigation, though often the cheapest and best way of getting rid of it for cities remote from the sea or large rivers, could not be looked upon as a possible source of profit any where ; and, in the case of Boston, rather as a scheme of large and uncertain cost with small, still more uncertain, returns.

The value of the solid ingredients of sewage is not doubted ; but the practical process of separating these from the water and bringing them into merchantable form has always cost more than could be recouped from such value, when the whole volume of sewage is so disposed of through wet weather and dry weather throughout the year.

In this respect the question is similar to that presented by mineral wealth under ground. Gold is well known to be present in many localities where it will not *pay* to mine it. Anthracite coal is also known to exist in considerable quantities around Narragansett Bay, but it costs more to get it out than to buy a better article brought from Pennsylvania, as has been well proven by those unfortunate persons who have spent their money in digging for it at Portsmouth, R. I. In fact, the number of holes in the ground that have failed to remunerate the diggers is, no doubt, far larger than the whole number of profitable mines.

(TO BE CONTINUED.)

CHICAGO WATER.*

ON September 5, 1885, the first of the weekly chemical examinations of the Chicago water-supply was made, and the following table exhibits the chemical determination of the sample drawn from the hydrant on each of the dates specified ; and, for the week preceding each date, the mean stage of the water in the river at the Bridgeport pumping-station—for convenience termed the "lake level;" the mean stage of water in the canal-lock at the same point ;† the mean difference between these stages—which indicates, approximately, the amount of work performed by the pumps ; the total precipitation—rain or snow ; the mean temperature ; the total wind movement and the prevailing direction of the wind.

* Extract from report by Dr. J. H. Rauch on the water-supply, etc., of Chicago, contained in the report of proceedings of the Illinois State Board of Health, quarterly meeting, October 23, 1886.

† These measurements, both for river and canal, are taken with the floor of the old lock as a basis—this being 6 feet 6 inches below datum. This preserves uniformity in all these measurements, and enables comparisons to be made between these observations and those of former reports. To find the lake or river level with reference to datum, subtract 6 feet 6 inches from the figures in the column "Lake."

Week Ending.	Chemical Determinations. Free Ammonia	Albuminoid Ammonia	Oxygen used.	Physical Condition.	Mean Levels of Water in Lake. F.	Lake. In.	Canal. Ft.	Canal. In.	Mean Difference. In.	Rainfall. In.	Temperature. °F.	Wind Movement. Miles.	Prevail'g direction
	In 1,000,000 parts.												
1885—September 5	.0090	.070	.40	Clear	9	11	10	2	3	.10	58.7	771	N.
" 12	.0220	.100	.80	Turbid	10	2	10	11	9	1.92	61.2	1,498	SW.
" 19	.0000	.080	.64	Clear	10	3	10	3	0	.93	66.8	1,342	W.
" 26	.0110	.092	1.68	Slightly turbid	9	11	10	6	7	.00	66.2	495	SW.
October 3	.0030	.090	.96	Slightly turbid	10	2	11	7	17	.30	63.7	1,131	N.
" 10	.0032	.072	.24	" "	9	10	11	8	22	.37	48.2	1,130	NW.
" 17	.0036	.084	.32	Clear	9	11	11	7	20	.63	56.	1,266	SW.
" 24	.0052	.070	.64	Turbid	9	11	12	5	30	2.24	47.3	1,516	SW.
" 31	.0060	.076	1.60	"	10	0	11	8	20	.35	48.1	1,618	N.
November 7	.0056	.081	1.68	Turbid	9	9	11	8	23	1.78	45.3	1,574	NW.
" 14	.0044	.078	1.44	"	9	4	9	4	0	.01	42.5	1,723	W.
" 21	.0050	.070	3.04	Very Turbid	9	6	9	6	0	.18	42.2	1,241	SW.
" 28	.0038	.066	2.74	" "	9	9	9	10	1	.36	51.9	1,404	NW.
December 5	.0030	.082	2.48	Very turbid	9	1	11	1	24	.07	36.1	1,486	SW.
" 12	.0052	.088	2.40	" "	9	1	11	5	28	2.08	20.2	1,691	SW.
" 19	.0048	.086	1.76	" "	8	10	12	0	38	.67	24.5	1,371	SW.
" 26	.0060	.096	2.08	" "	9	5	12	c	31	.12	37.6	1.503	SW.
1886—January 2	.016	.086	1.36	Turbid	9	3	11	9	30	.41	40.3	1,215	S
" 9	.011	.088	1.40	"	10	0	12	3	27	.98	25.4	1,967	NW.
" 16	.0212	.106	1.60	"	9	5	12	4	35	.80	15.8	1,967	W.
" 23	.0266	.082	1.40	Slightly turbid	9	4	12	5	37	1.18	13.5	1,553	SW.
" 30	.0132	.090	1.12	Steadily improving	9	4	12	9	41	.45	26.0	1,505	NW.
February 6	.0080	.076	1.08	Clear	9	4	12	10	42	.07	10.0	1,526	SW.
" 13	.0084	.080	1.44	"	9	9	10	11	14	.61	42.4	1,404	SE.
" 20	.0266	.086	1.52	Slightly turbid	9	8	10	5	9	.21	27.5	1,849	W.
" 27	.0270	.076	2.40	" "	9	6	11	1	19	.42	29.6	1,991	S.
March 6	.0040	.072	.96	Clear	9	7	12	4	33	.01	26.8	1,427	NW.
" 13	.0060	.072	.80	"	9	5	11	10	29	.31	30.7	1,596	SW.
" 20	.0040	.070	1.12	"	9	9	12	0	27	.46	43.7	1,373	N.
" 27	.0050	.080	1.76	Slightly turbid	10	2	10	5	3	.17	38.8	1,808	NW.
April 3	.0020	.084	1.76	Turbid	9	11	9	11	0	.89	33.3	1,778	SW.
" 10	.0030	.076	2.08	"	9	10	9	10	0	.00	40.4	1,600	NW.
" 17	.0048	.076	1.04	"	10	0	11	1	13	.57	54.3	1,231	SE.
" 24	.0050	.080	.96	"	9	11	11	8	21	.00	58.2	1,208	SW.
May 1	.0000	.070	.88	Good	10	2	11	10	20	.67	51.2	1,558	SW.
" 8	.0000	.072	.80	Clear	10	3	11	9	18	.11	54.8	1,344	NE.
" 15	.0020	.074	.24	"	10	5	12	5	24	.83	55.6	1,297	SE.
" 22	.0040	.070	.24	"	10	5	11	11	18	.04	58.9	1,455	SW.
" 29	.0000	.064	1.20	"	10	3	11	9	18	.01	60.1	1,428	SW.
June 5	.0000	.070	1.04	Clear	10	5	11	9	16	.10	61.1	1,242	NE.
" 12	.0000	.068	1.12	"	10	3	11	8	17	.00	62.3	1,151	NE.
" 19	.0000	.068	1.28	"	10	3	11	8	17	.77	70.7	1,141	SE.
" 26	.0020	.066	1.20	"	10	4	11	8	16	.07	66.1	1,008	SE.
July 3	.0000	.066	1.44	Clear	10	5	11	8	15	.00	68.4	1,121	NE.
" 10	.0920	.072	1.12	Slightly turbid	10	2	11	8	18	.21	73.9	1,274	NE.
" 17	.0030	.060	1.44	" "	10	5	11	9	16	.61	68.2	1,421	N.
" 24	.0050	.072	1.28	" "	10	3	11	8	17	.56	68.2	1,119	NE.
" 31	.0036	.068	1.44	Clear	10	1	11	8	19	.15	75.0	1,259	NE.
August 7	.0034	.066	1.52	Clear	10	1	11	8	19	.15	69.6	1,043	NE.
" 14	0020	.064	.72	Nearly Clear	9	9	11	7	22	.38	74.9	1,293	S.
" 21	.0020	.070	.88	" "	10	0	11	9	21	1.07	73.2	1,319	NE.
" 28	.0000	.074	.96	" "	10	1	11	10	20	.68	74.3	1,270	E.

DOMESTIC
PLUMBING HEATING LIGHTING & VENTILATION
ENGINEERING

WARMING PASSENGER-CARS BY STEAM.

IN the early issues of THE SANITARY ENGINEER AND CONSTRUCTION RECORD we advocad warming cars from an outside source, and directed attention to the danger of a fire within a car.

In our issue of January 26, 1882, we illustrated and described the first system used on the elevated roads of New York.

It consisted of a long pipe-heater, extending nearly the length of the car, underneath the seats, supported on iron stands a few inches above the floor. It was in three sections or lengths of about 10 feet each, and consisted of 1¼-inch steam-pipes enclosed within a 4½-inch galvanized-iron case or jacket, the annular space formed between the steam-pipe and the jacket being filled with dried sand.

The sand about the steam-pipe was intended to act as a receiver and reservoir of heat, to be given off at times when engines were on up grades or when the supply of steam was interrupted for a short time. It did not prove satisfactory, however, as a car-warmer, for the reason that when steam was in the pipe the sand prevented and obstructed the free radiation of heat, as it was a poor conductor, and was also a failure as a storer of heat on account of its very low specific heat.

Master Mechanic Peebles, of the New York Elevated Road, then tried 3-inch steam-pipes, plain, on some eighty cars, which gave ample heat when steam was on, but had no heat-storing capacity to carry over interruptions, other than that which the iron of the pipes was capable of holding, which was exceedingly small on account again of the low specific heat of iron.

On Feburary 16, 1882, we illustrated and described an improvement on the Peebles plan, suggested for the Manhattan Elevated Railroad cars, by Edward E. Gold, of New York, whereby heat was stored in water, and which also contemplated the ventilation of the cars, with power to shut off the heat from each seat.

This consisted of branches taken from the horizontal 3-inch main, under each cross-seat, in the shape of a branch-loop of ¾-inch pipe inside a short 3-inch cylinder filled with brine, the latter to form heat-reservoirs—water being selected on account of its great specific heat. In this form it never came into use, as it was somewhat complicated and expensive.

This principle was simplified, however, and is now used in the horizontal position in one of its modified forms under the seats of the cars of the New York elevated roads.

At first it consisted of a 1¼-inch pipe extending through a 3-inch pipe, the latter being nearly filled with brine. When steam was turned on the brine was made as hot, or nearly so, as the steam. When steam was interrupted, the heat stored in the water was given off, and it was found that about two hours' extra warming could be obtained from it, for the very simple reason that water has the highest specific heat of any known available substance.

The form of this pipe or water-reservoir was again changed so as to have a pipe of about three inches diameter inside one of about four inches in diameter. The steam instead of being admitted to the inner pipe is admitted to the space between the pipes, the inner pipe being filled with brine, except a small space on top for expan-

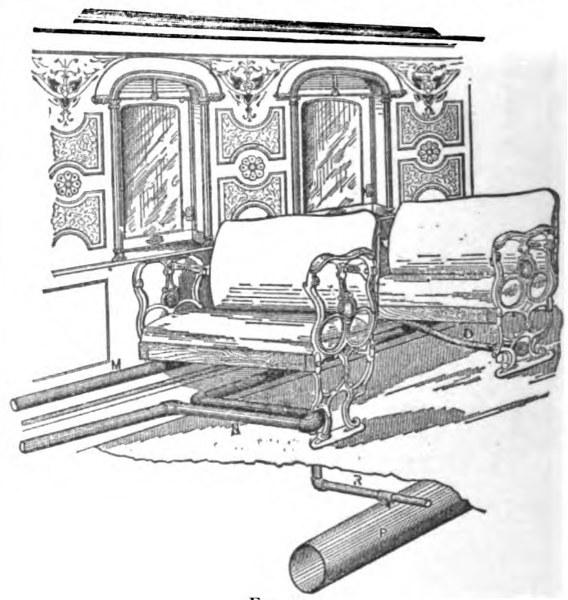
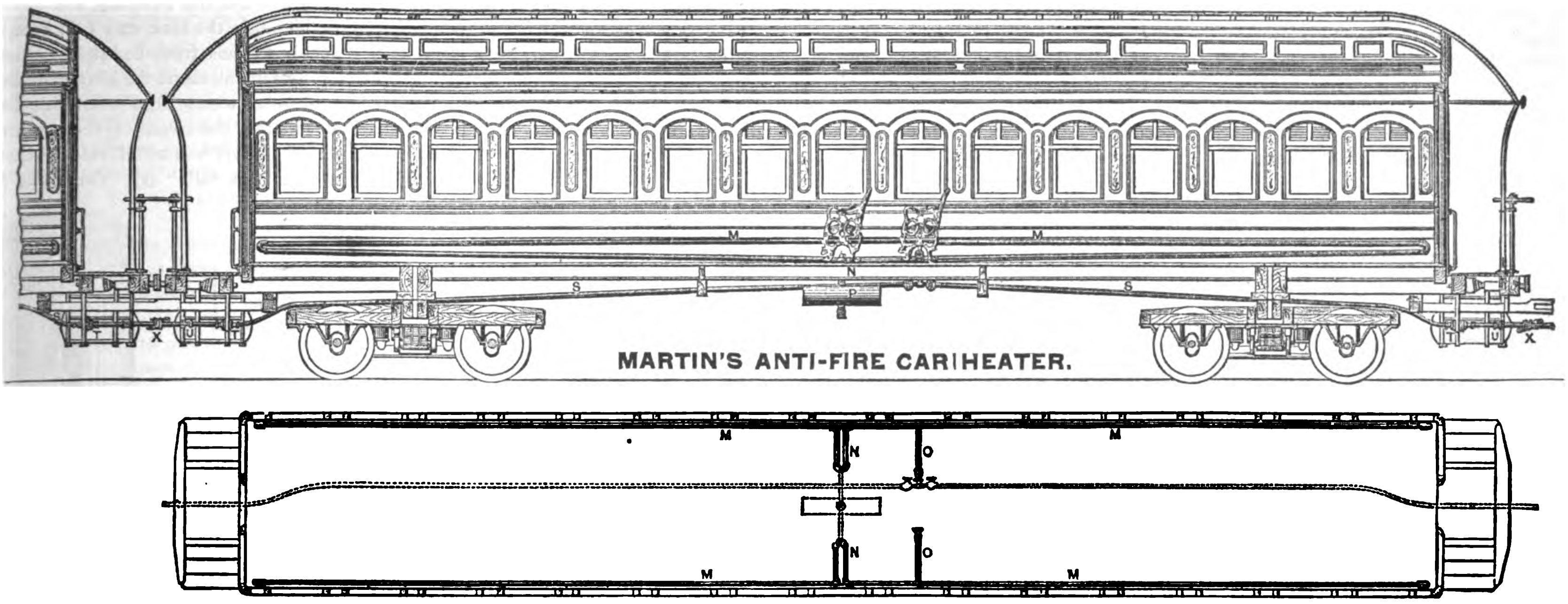


FIG. 3.

sion of the liquid. Then when steam is turned into a cooled cylinder, it at once warms the outer pipe without having to wait for the inner one or reservoir to warm first. When steam is interrupted again, the inner reservoir lying loose within the outer pipe imparts its heat to the outer one by radiation and by contact at their bottoms, the small quantity of condensed water which remains between them assisting the contact. By this arrangement cars cut off from their supply of heat, as on the cable road in Hoboken, for example, are kept warm for a trip.

In our issue of December 28, 1882, we illustrated the Graydon system of heating railway-cars. This was the invention of J. W. Graydon, U. S. N., and it was tried during 1881 on the Troy and Boston Railroad. By this system it was contemplated to take the steam, live or exhaust, either from the locomotive direct, or live from boiler in the baggage-car, or from stationary boilers at the depots. Our illustration showed a reservoir of water in the baggage-car. Small horizontal reservoirs of water were placed under the seats. While being charged with heat the main reservoir is shut off from the steam-pipes by stop-valves. When these valves are opened the high-pressure steam in the reservoir decreases, and a large portion of the hot water that was under high pressure becomes steam at a gradually decreasing pressure, which circulates around the train and goes on as steam until the temperature and pressure is reduced to that due to atmosphere. The small reservoirs, which are also the heaters, are partly filled with water. A coil of small pipe of three lengths passes back and forth through them. The upper pipe of the coil is perforated and is above the water-line, while the lower two pass through the water. When steam is admitted to the coil it heats the water and is free to pass through the small holes.



MARTIN'S ANTI-FIRE CAR HEATER.

FIGURE 1.

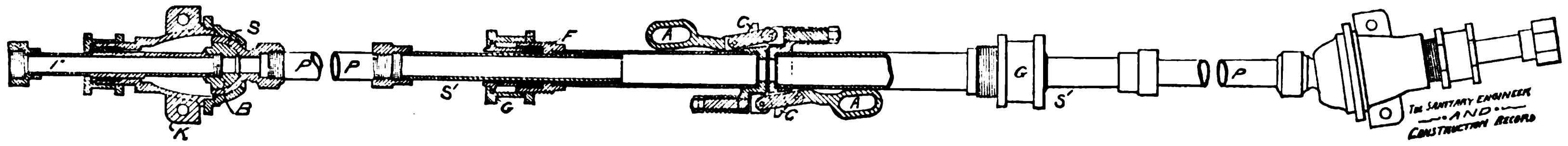
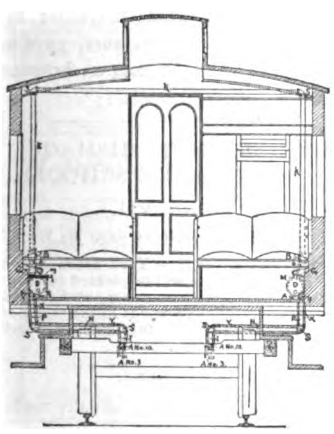
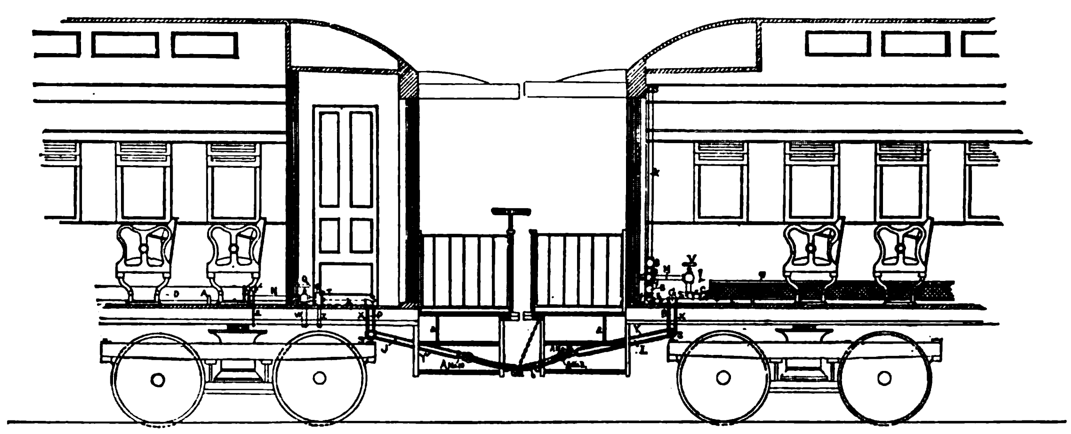


FIGURE 2.

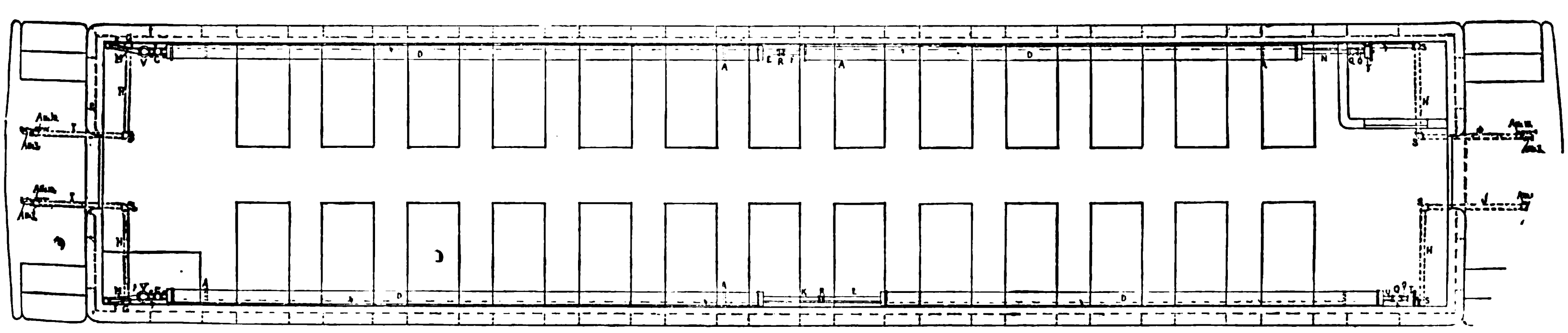


CROSS SECTION.



SECTION SHOWING CONNECTIONS BETWEEN CARS.

GOLD'S SYSTEM OF HEATING AND VENTILATING RAILWAY CARS.



PLAN.

FIGURE 4.

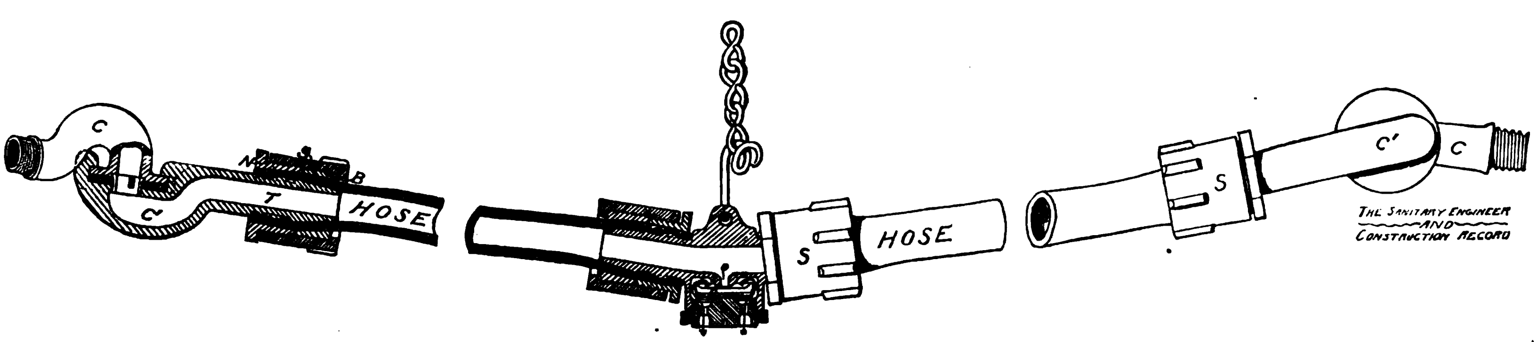


FIGURE 5

When the steam is shut off and the pressure on the water begins to decrease, the steam given off by the water passes back into the pipes through the holes. The excess of water also passes off the same way so as to leave the reservoir only two-thirds full to lessen the danger from freezing.

A flexible metallic connection between the cars with ball and socket joints was part of this scheme. Of its success we are not informed.

At present there are three systems of steam-heating for cars attracting much attention: The "Martin" anti-fire car-heater, which is being tried on the Cleveland, Columbus, Cincinnati, and Indianapolis Road, the Dunkirk, Allegheny Valley, and Pittsburg Road, and experimentally on the Long Island Railroad, is one. Another is the "Gold" system, which is in use on the elevated roads of New York, the Staten Island Rapid-Transit Roads, the Cable Road at Hoboken, and on a Hoboken surface horse-car road, which in some cases take steam from the locomotive and in the others from stationary boilers at terminal stations. This system is also being tried experimentally by the Long Island Railroad. The third is the "Emerson" system, in experimental use on the Boston and Albany Railroad and the Connecticut Valley Railroad.

The Martin system consists of a 2-inch steam-pipe running twice the length of each side of the car, forming a regular coil, M M, shown in Fig. 1. It is highest at the centre of the top pipe and drops both ways to the centre of the bottom one. *Tees* are placed along at the centre of every seat in the bottom pipe and usually plugged, but in very cold situations 2-inch pipes, three feet long or thereabouts, with closed ends, can be screwed into them to increase the surface and make a kind of foot-rest.

Figure 2 illustrates the method of distributing the heat adopted. A main-pipe, wrapped to prevent much condensation, runs from one end to the other, under the coach, as indicated by dotted lines. On each end are screwed the metallic couplings shown in Fig. 2. At the centre of this line two branch-pipes O pass off and up through the floor on each side of the aisle, as indicated in plan, Fig. 1. On each side of these branches, in dotted lines, are valves to prevent the steam blowing off in the rear of the train should the car be the rear one. Steam passes from these branches O into radiating-pipe M, and goes to each end of the car and returns to the centre at N, where it passes down through return-bend into R, thence into the tank or trap P indicated, seen under car.

Under the end of seat in the pipe O is an angle-valve by which the steam is let into radiating-pipes M, or shut out in main pipe S, to enable the trainmen to shut it out of any car without affecting the other cars of the train.

An expansion-trap is used on the return-pipe of each car. It is made of a brass pipe within an iron one, with an adjustable seat, the change of temperature affecting the brass in a ratio about twice as great as the iron.

The couplings between the cars are made of brass. Reference to Fig. 2 will show its construction and appearance. It is made of two ball and socket joints of novel construction, as shown in Fig. 2 at S S, two slip-joints, G G, and couplings C C. The ball-joints are fastened under the platforms of the cars, as seen at T T, Fig. 1, and the joint is at X.

The joint is a cup and ball, having a half-ball B, with a hemispherical shell S, ground to a steam-tight surface on both sides. Outside this shell S is an outer sphere, divided in half, and screwed together. At the adjusting nut there is a shoulder on the stem, against which the adjusting nut impinges, forcing ball B against shell S and that against outer sphere. Attached to this by a nipple P is the sliding joint. On the end of sliding joints is the connection proper, consisting of two halves, exactly alike, having metallic gaskets. Levers A A are placed over studs C C and press them down. To uncouple, one lever (A) is pulled over stud C, and the couplings separate.

Figure 3 shows the inside of a car with the parts in perspective; the same letters applying to corresponding parts in Fig. 1.

Three to seven pounds pressure of steam is used. Live steam from the locomotive is used by putting a dry pipe in the dome, with a cut-off valve in the cab, to which is attached a reducing-valve. From the reducing-valve a small pipe passes beneath the foot-board of the engine, to which is secured one of the joints shown in Fig. 2. From this a pipe is run under the tender, properly wrapped, so as to prevent condensation.

We now come to the latest details of the apparatus in use on the elevated roads of New York, as proposed for general railroad purposes.

Figure 4 shows a plan of a whole car, with a longitudinal section through the end of two cars, showing the connection between them, and a cross-section through a car to show the relative positions of objects within. Like letters apply to like parts in the different views of the car.

The radiators are the water-cylinders D D. They are five inches in diameter, two on a side, and from sixteen to twenty feet long, or as may be required for a car. They are set upon stands, with the under side of them 1½ inches from the floor, and may be used with or without screens; the latter being shown at the right of the drawing if an ornamental appearance is required. Within the radiator is a somewhat smaller pipe filled with brine, as before explained for the elevated road, and in all essential principles the systems are the same.

The principal point of difference lies in the arrangement for controlling the heat of cars separately and leaving it in the power of the conductor to shut off or let on a car. To accomplish this a 1-inch pipe *h*, conveying live steam, is run along the car, below and behind the radiators. By the means of this pipe, which runs along both sides of a car, steam can be turned into any or all of the heaters, and the waste can be allowed to escape at the end of the train, or a circuit may be formed by allowing the steam to pass down one side of the train and back on the other side. By the manipulation of the valves B B, V and Q, any of these conditions can be brought about. Outside the valve Q in in each car is used a steam trap, T. The object of this trap is, of course, to separate the condensed water from the steam. It consists of a hollow disk of metal partly filled with alcohol or other suitable easily evaporized liquid. When the heat at the trap vaporizes the liquid the trap closes by expanding the disk against the seat of the opening, shutting off the steam. When water forms and it cools below what the trap is set for, it opens and the water runs off.

Figure 5 shows the method of connecting the cars in detail. The pipes P P extend through the flooring of the cars and run rigidly to A. No. 10, where special inch stop-cocks with 12-inch lever-handles are used. To these cocks the half-couplings C and C are attached, permanently remaining with the car and always being closed at the end of a train or where the hose is disconnected. The halves of the couplings C′ and C′, which are identical in construction, and will match with any of the parts C, lock into them with a sixth of a turn. These parts are fastened to short lengths of special steam-hose by suitable couplings S S, and a trap D suspended with a chain is fastened into the centre of the loop thus formed. This part from C′ to C′ is loose and held to the platform by the chain in the trap and is fastened to the permanent parts by lifting it in the middle, bringing the faces of the couplings into place, and then allowing it to hang down. A downward pull in the middle jambs it tight and the force of gravity thereafter keeps it to its face as the train rattles along. A lift in the middle disconnects both ends. The coupling on the left of the Fig. 5 is shown turned out of its natural position to show the joints.

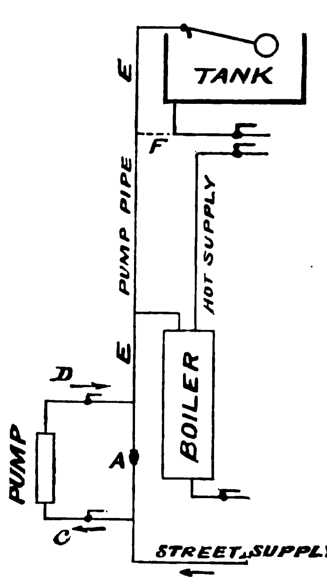
The object of the trap in the middle of the connecting link is to allow the water that might collect there and cause freezing to run out should the car be out of use or the steam shut off.

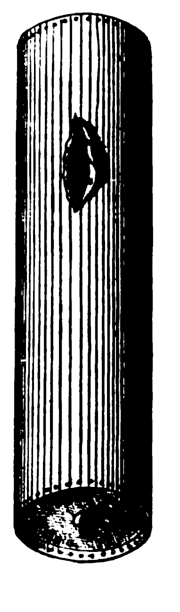
As soon as we get the details of the Emerson system we shall give them to our readers.

BURSTING OF A HOUSE-BOILER.

THE bursting of another boiler this week only confirms the opinion that has always been held by THE SANITARY ENGINEER AND CONSTRUCTION RECORD—*i. e.*, that every domestic boiler should be provided with a relief-pipe.

The accompanying illustration shows at a glance the cause of this last accident. The house was originally supplied with water by street-pressure; but within the last two or three years the head of water became so low that it was decided to introduce the tank system. As, however, this must be done at the least possible cost, only those fixtures above the first floor were to receive the increased supply, and even those only with cold water. Acting under his instructions and up to his light, the plumber placed the check-valve (A) on the street-supply below the boiler, inserted a hand-pump in the by-pass (C D), extended the cold-water supply-pipe (E) over the tank, and attached a ball-cock to prevent an overflow in the event of the street-pressure becoming heavy enough to fill the tank. Then, after removing the pipe (F) and connecting the top of the cold water system with the tank, the work was declared finished. Things worked well for some time, till one morning the man who did the pumping, not having any tell-tale to warn him that the tank was full, kept to his work, until suddenly screams from the kitchen caused him to desist. Going upstairs he found the kitchen flooded with hot water and the boiler with a large hole in it. Our readers have already surmised the causes of the accident. There were several: (1) There was no tell-tale to inform the man when the tank was full. (2) There was no





relief-pipe on the boiler. (3) No one happened to draw water at the right moment to relieve the pressure. The consequences were, the moment the tank was full, the ball-cock closed, and every other outlet being closed, the pump was worked against the whole hot-water system, which finally, under the excessive pressure, gave way, and the boiler, which being of light copper, happened to be the weakest point.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. VII.

(Continued from page 322.)

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

BOILERS.

1. Of what metals are boilers usually made?

Copper and galvanized iron.

2. How much should a copper 40-gallon boiler weigh?

About 75 pounds.

3. How much should one of 60 gallons weigh?

About 125 pounds.

4. How much should one of iron weigh for 40 gallons?

About 120 pounds.

5. How much if 60 gallons?

About 180 pounds.

6. How are they usually placed?

On cast-iron stands beside range. They are sometimes hung from the ceiling.

7. Is it of any consequence where they are placed?

Yes; they should be placed close to the range and have couplings so arranged as to permit proper circulation between range and boiler.

8. Where should the cold-water supply-pipe enter a boiler?

At the top.

9. How should the circulating-pipes between boiler and water-back be arranged?

The return or hot-water pipe from water-back to boiler should have a gradual ascent to boiler without trap or dip. The cold-water pipe from boiler to water-back should have no trap in it.

10. Is there any advantage in having the hot circulating-pipe larger than the cold one?

There is; as circulation is better because freer, and besides rumbling and bursting of pipes is less likely to occur.

11. What is the usual size of these pipes?

For ordinary sized houses ¾-inch or ⅝-inch for cold water and 1-inch for the hot-water return-pipe.

12. What causes the rumbling sound in boilers?

If circulation is impeded steam is formed, and its sudden condensation causes the rumbling because of the water coming violently together.

13. What is the usual cause of explosion in a water-back?

The stoppage of the circulation causes steam to be rapidly generated; an explosion must occur as if cannot escape.

14. When the water in a boiler is generating steam rapidly what effect may drawing off the hot water have?

It may collapse the boiler from the sudden entrance of cold water causing condensation.

15. Why does this condensation of steam endanger a boiler.

Because of the boiler containing a quantity of steam; when cold water is admitted a vacuum is formed instantly; this causes a pressure of about a ton on every square foot of external surface.

16. What is the pressure of the atmosphere?

Nearly 15 pounds to the square inch.

17. Is a collapse more likely to happen when the water-pressure is light?

Yes, as steam is more easily generated and less pressure is required to expel water from boiler; the cause of collapse is therefore more frequent.

18. What is the usual safeguard against the collapse of a boiler?

Putting in a pipe (expansion) which should be carried to the highest possible point; also, by a safety and vacuum valve or a simple valve-coupling.

19. Can the hot-water service-pipe be used in this way?

Yes; the hot water can be carried above the tank and turned into it.

20. Is the expansion-pipe ever omitted?

Yes; and when boiler is supplied direct from street-main, and pressure is great enough to flow above house, it cannot be put in; a vacuum-valve in that case is necessary.

21. Are wrought-iron boilers stronger than copper, and why are they used?

They are usually stronger because heavier; they are also cheaper and less liable to collapse.

22. What cold-water pressure will the average copper boiler stand?

From 75 pounds to 100 pounds.

(TO BE CONTINUED.)

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

THE ROCHESTER PLUMBING REGULATIONS.

ROCHESTER, N. Y., January 31, 1887.

SIR: Your criticism or suggestions in reference to rules, etc., is somewhat in error. Section 10, fresh-air inlet opening *at or near* street-curb. The clause left discretionary with inspector so as to get it far enough away from windows or cold-air boxes to furnaces. Section 12, error of the printers.

Section 18 has not been construed properly by you. It has reference to a small stop-cock tapped in soil-pipe for the convenience of inspector to apply his testing apparatus, and not a 4-inch cock as you imply.

Section 26 does not read as it was intended. It is meant that the iron and lead pipe connection must be made by a soldering union and not a stiff stationary joint. It is so understood by the plumbers here. Our inspector has got a very ingenious device for applying the peppermint test to either old or new work. It can be applied through any fixture without getting any of the odors in the room unless through defect in the piping.

Yours, etc., J. HENRY HOWE.

[This refers to comments printed in issue of January 23. A temporary absence of the writer resulted in an oversight that prevented the appearance of the above letter in a former issue. A reference to our comments and the clauses referred to will indicate that the criticisms were justified by the rules as they were printed, and our correspondent explains what was not clear before. We suggest these corrections be made in the text when the rules are again printed.]

HOW TO PREVENT INJURY FROM SUSPECTED SOIL UNDER A BUILDING.

149 SECOND STREET, MACON, GEO.,
January 31, 1887.

SIR: A brick building, built for armory purposes, two stories in height, and with outer walls two feet thick. No basement, but with excavations of say six feet under first floor, building 50x300 feet, and with ten cross-walls of brick in the basement. Has been standing for twenty years with from two feet to no water at all covering the whole surface of the basement. Water entering through the rain-water leaders that are carried down within the walls. Query: What time should elapse between the draining of the pond and the occupancy of the building as a home for orphan children? I would state that there has been considerable typhoid fever in the neighborhood, for which the laboratory pond has received its share of abuse. An early answer by mail or through your journal will be appreciated.

Yours truly, P. E. DENNIS.

[After the ground beneath the building has been thoroughly dried, additional delay will have little influence on its healthfulness. If there is any reason to suppose that the water which was in the basement was contaminated by sewage, or if its removal is not thoroughly and completely effected so as to leave no trace of dampness, security from specific germs in the soil may be obtained by wetting it thoroughly with a solution of corrosive sublimate, 1 part to 1,000 of water.]

FORT GIBSON, I. T., February 17, 1887.

SIR: Please inform me where to address the Baldwin Refrigerator Company, and oblige, Respectfully yours,
JOHN ANDERSON, 1st Lieut. 18th Inf., Post. Q. M.

[Referred to our readers.]

HEATING RAILWAY-CARS FROM AN OUTSIDE SOURCE.

BOSTON, February 21, 1887.

SIR: THE SANITARY ENGINEER AND CONSTRUCTION RECORD has published considerable correspondence in reference to heating railroad-cars of late. I would like to make a suggestion: In lighting by electricity, storage-batteries have been tried in different form as either a source or regulator of light.

Why not use a *storage of heat* in heating the cars by steam from the locomotive?

On the London and Northwestern Railroad, in England, on the Eastern and Western Railroads in France, in Spain, Portugal, and Austria, some years ago, the Ancelin system of heating was introduced on the cars. This system consists of small flat tanks of acetate of soda, which is first heated to the melting point of the chemical and then put in the cars to throw out heat while the acetate is crystallizing again. The material melts below 212° Fah., and it has been found by experiments that reservoirs containing 33 lbs. of acetate of soda and heated to 176° took some fifteen hours to cool off to 100° while they were throwing off 1,730 calorics, or 88 per cent. of the amount of heat necessary to heat them to 176° in the first place.

My suggestion would be to have similar reservoirs under each seat in the car, with a circulation of steam through them from the locomotive. As long as steam was applied and the crystals melted heat would be thrown off the same as from a hot-water coil. But, when the car was detached, the chemicals themselves would throw off heat sufficient probably to keep the car warm through the night, or till again connected to a train.

Express trains usually have but few stops, but when they do stop the steam-pressure on locomotive increases rapidly, so that usually the extra steam has to be blown off during the stop. By this arrangement of reservoirs this extra steam could be run through the cars and thus replenish the store of heat in reservoir, and in this way diminish considerably the amount of steam needed in the cars during the running time of the locomotive.

Y. N. S.

A FILTER WANTED.

OMAHA, NEB., February 28, 1887.

SIR: Will you through your valuable paper give a subscriber the desired information as to the best filter to use on supply in Omaha water, taken from the Missouri, very muddy and high pressure at 110 pounds? By so doing you will oblige, Yours, etc., W. SPELLMAN.

[We cannot recommend any special appliance. Our invariable rule is to refer inquirers to our advertising columns, and suggest that they use discretion in selecting from what is there present.]

BRIDGE-BUILDING AND MUNICIPAL IMPROVEMENTS AT LOS ANGELES, CAL.

(From An Occasional Correspondent.)

LOS ANGELES, CAL., February 21, 1887.

THE foundation for an iron bridge across the Los Angeles River has for some time been completed. It consists of four concrete piers, each containing about 110 cubic yards of concrete. The piers rest on a pile foundation.

The bridge will be in total 552 feet long, and is constructed as follows:

Wooden approach, 32-foot spans (temp.)		128 feet
Three 100-foot spans		300 "
Two 52-foot spans / One 24-foot span	Viaduct over railroad	124 "
		552 feet.

The roadway is 19 feet in the clear; the sidewalks on either side are 5 feet in the clear; the bridge is a deck; is calculated to carry 100 pounds per square foot, and the dead weight was taken at 1,100 pounds per lineal foot of bridge. All posts are built of channels, laced on top and bottom. The floor-joists are of wood.

The iron-work will soon be erected. The contract was awarded to the San Francisco Bridge Company for the sum of $22,000, of which sum $6,000 went to the foundation.

At the meeting of the council a week ago bids for two new bridges were received, one to go across the Los Angeles River, to be 318 feet long, and to consist of three spans, the other to go across the Arroyo Seco, and to be 100 feet span.

The bridge across the river has a roadway of thirty feet, centre to centre of truss, and provisions for two 5-foot sidewalks. The live load was taken at 100 pounds per square foot for the 30-foot roadway and 80 pounds per square foot for the sidewalks. The bridge is to be a through bridge, and will be a Combination Pratt. The floor-beams over piers will be of iron, the intermediate ones of wood; the joists are to be of wood; timbers to be planed. The foundation consists of iron cylinder piers of the Cushing patent, cylinders to be four feet diameter, ⅜-inch iron; struts between cylinders to be of channels laced on both sides.

The San Francisco Bridge Company was the lowest bidder for this bridge; bid nearly $16,000.

The 100-foot bridge across the Arroyo rests on iron cylinders, 30 inches in diameter, is 20 feet wide, and will be awarded to the lowest bidder. The San Francisco Bridge Co. bid $2,500.

Before long we will have to erect another iron bridge across the river. Bridge to be about 300 feet long, 60 feet wide, and to have three trusses, masonry foundation, and to be a 100-pound bridge of the first order.

Eastern companies have up to this date made very little effort to enter our country.

The city authorities have also under consideration plans for sewering the city. It must here naturally be the separate system; sewage to be utilized on irrigation farms. We have no paved streets, but good granite and asphalt in the immediate neighborhood, and we shall some of these days make good use of these materials.

MILWAUKEE (Special correspondence.)—A Committee of the City Council is again wrestling with the garbage disposal problem. The alternative plans of taking it into the country, dumping it in the lake, and building two cremators to consume it are being considered. The Minnesota Garbage and Filth Co. propose two cremators to cost $5,000 each; rent of land $500 for each furnace, and cost of running about $15.50 per day.

THE DEMON CAR-STOVE.

VARIOUS PLANS SUGGESTED FOR GETTING THE BETTER OF IT.

AFTER the train had fairly got started there was a sort of convention held in our coach, says a writer in the Detroit *Free Press*, and it was solomnly

"*Resolved*, that the railroad companies must find some safer means of heating their cars."

The chairman of the convention called for an expression of opinions, and here are some of the opinions:

1. I think that they orter keep a man and a pail of water for each stove, and in case of accident he is to douse out the fire.

2. The bottom of all car-stoves should be made to work on a hinge, and this hinge should be worked from the engine. You have seen how the bucket of a dredge works? Well, that's the principle exactly. I'd have it so that in case of danger, the engineer could drop the bottom out of every stove on the train, and leave the fire on the track. I may say that the idea is strictly original with me, but of course I don't want any particular credit for it. Such brilliant strokes come natural to me.

3. My plan is to heat with steam from mills and factories along the route. I don't know just how the details could be carried out, but that's none of my business. I've got three saw-mills on this line, and I'd sell 'em steam at cost.

4. This heating has got to be done with hot water, and the water has got to be kept hot by the motion of the cars. It must be so arranged that it will all run out on the ground in case of accident. If I had a few days to myself I could

think up some way to make it work, but my old woman is sick, half my sheep need doctoring, and I've got two lawsuits on hand. Some of you fellows work it out.

5. (By a woman.) My way would be to keep a big kettle of water on each stove, and have it so fixed that, in case of accident, the bottom of the kettle would drop out and let the water subdue the merciless flames.

6. Now, you look here. This whole heating system is wrong—radically wrong. The heating ought to be done by electricity taken from the telegraph-wires and conveyed through steam-pipes to different portions of a car. I'm selling groceries on the road at $70 per month, and I haven't time to work out such a problem, but some of you folks ought to take hold of it. There's a cool million dollars in the idea.

7. (By another woman.) My husband says they ought to store up enough heat in the summer to last all winter. I didn't ask him how they'd do it, but I'm sure he's right. He can guess the weather a whole week ahead, and he's figured out that the sun is only twenty-eight miles from the earth.

8. Vell, I doan' like to be burned oop mit a hot shtove, und so I vhas busy mit some plan aboudt it. How vhas it if der railroadt gompany haf a nice place eafery fife miles on der road, und we all shtop in und get warm und have some beer und free lunch? Nopody gets burned oop dot vhay, und all vhas peace und shoy und happiness.

9. Me? I don't care a button! I have been in twenty-one railroad accidents and never got hurt, and I'm willing to take my chances. I always carry a saw, hammer, cold chisel, crowbar, and jackscrew in my pockets, and in case the car falls off a bridge and I am caught in the wreck, I shall go to work to get myself out. Nothing like depending on your own exertions.—*Detroit Free Press.*

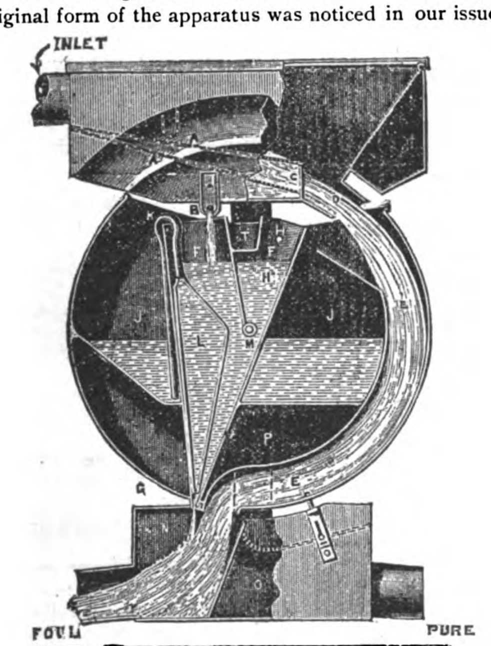
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

ROBERTS' RAIN-WATER SEPARATOR.

WHEN rain-water is depended on for a domestic water-supply it is important that it be as free from dirt and impurities as possible, and the object of this invention is to divert from the storage-cistern the first flow of a rainfall from roofs, which, of course, contains more or less dust, soot, etc.

The illustration shows an improved form of Roberts' rain-water separator for storing clear water after running the first washings of the roof to waste. The earlier and original form of the apparatus was noticed in our issue of



SECTION OF HORIZONTAL SEPARATOR

November 16, 1882. The apparatus consists of three chambers—the upper (receiving-chamber) and the bottom (discharging-chamber), which are fixed, and the centre or canting-chamber, upon the action of which the utility of the apparatus depends. This centre chamber pivots on ends.

The water during the earlier portion of the rainfall coming from the roof is passed into the upper chamber, passing thence through two strainers A A, through the sluice C (which is adjustable to the size of the roof) into the canter through the spout D, running round by E E, and out at the foot, being discharged into the left-hand compartment N of the bottom chamber, and running thence either to waste or to a separate storage-tank. If there is only a little rain the entire fall percolates through the strainers into the lower portion of the chamber and out at a small hole B in the movable slide, thence into the funnel F, which is provided with a small hole G at the bottom, slightly smaller than the one at B. Owing to the slight difference in the sizes of the holes G and B a very slight rain will all run out of this funnel F without operating the canter. If, however, there is a moderately heavy rain it gradually rises in the funnel L and F until it reaches the holes H H through which it passes into the chamber J J. The weight of the water in this chamber is so adjusted that when the level reaches a certain height the canter or tilting-chamber is overbalanced and the outgo is shifted two inches to the right into the right-hand compartment N of the chamber at foot, running thence to the storage-tank. While the canter is in this position the water from B, instead of passing into the funnel F, passes into the lip T, which is in direct communication with the chamber J J. The funnel F is provided with the syphon K, leading into the chamber J J. As the water sinks in this chamber action is set up in the syphon and the funnel L F is emptied into J J, and when this chamber J J is emptied the canter recovers its normal position, ready for the next rainfall, having stored the last drop of its contents. The maker and patentee of the apparatus is C. G. Roberts, of Haslemere, Surrey, Eng. This apparatus was patented in the United States December 14, 1886.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
February 26.......	24.94	19.82	20.95	29.27	28.60	20.34	32.63

E. G. LOVE, Ph.D., *Gas Examiner.*

THE Florida Water-Gas Company, of Jacksonville, Fla., propose their gas for car-lighting. A test-car has been run on the Maine Central Railroad.

OUR Cincinnati correspondent writes under date of February 28: "The Cincinnati Gas-Light and Coke Company has a contract with the city whereby the company furnishes gas to private consumers at $1.65 per 1,000 feet, with ten per cent. off for prompt payment. This contract expires in three years. Recently the company agreed to make a new contract for ten years, beginning at once, at $1.25 per 1,000 feet, with ten per cent. off. This was rejected. To-day an ordinance was finally passed to make the price $1.15, with ten per cent. off, for the ensuing years, the understanding being that the gas company will accept. The presence of two electric-light companies and the promise of natural-gas, piped from northern Ohio fields, have reduced the price of coal-gas."

THE United States Senate has passed the House joint resolution providing that a gold medal be presented to Joseph Francis for his services in inventing life-saving appliances.

STATE LEGISLATION RELATING TO THE HEATING AND LIGHTING OF RAILROAD-CARS.

WE give below the text of bills now under consideration in the Legislature of Rhode Island:

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS, JANUARY SESSION, A. D. 1887.

It is enacted by the General Assembly as follows:

An Act in amendment of Chapter 158, "of Railroad Corporations."

SECTION 1. Every railroad corporation whose cars are propelled by steam, shall cause to be carried in each and every car of its passenger trains two chemical fire-extinguishers, which shall be known to be at all times in order for use, also six fire hand-grenades, grouped in a convenient receptacle to faciliate their being carried from such car to the place where they are intended to be used, and also each locomotive of such train shall carry eight buckets, to be kept in order to use for fire purposes only.

SEC. 2. Every such corporation shall cause to be attached to each side, on the outside of each and every car of its passenger trains, one steel bar, one sledge, one axe, and one saw, which shall at all times be kept in order for use.

SEC. 3. Every such corporation shall cause each and every car of its passenger trains to be lighted by gas or electricity whenever artificial light shall be required.

SEC. 4. Every such corporation shall cause each and every car of its passenger trains to be sufficiently heated for the comfort of its passengers, but no fire shall be built or maintained except in the locomotive in or on any train on which passengers are carried, nor shall any petroleum or naphtha, or any illuminating oil or fluid made in part of naphtha, or wholly or in part from coal or petroleum, be carried or used in or on any such cars for lighting the same.

SEC. 5. Sections 1 and 2 of this Act shall take effect Monday, May 2 next. Sections 3 and 4 shall take effect Monday, October 2 next, and every such corporation which shall neglect or refuse to comply with the provisions of either of the foregoing sections shall be fined not exceeding $1,000 for each offense, one-half thereof to the use of the complainant and one-half thereof to the use of the State, and such corporation shall be liable for all damages sustained by any person by reason of such neglect or refusal on the part of the corporation.

SEC. 6. It shall be the duty of the Railroad Commissioner to examine quarterly, beginning July 1 next, into the condition of all the features embodied in this Act, for the better security and comfort of the traveling public in this State, on such cars, and to report his findings in detail for each quarter, to the General Assembly at its January session, each year.

SEC. 7. All acts and parts of acts inconsistent herewith are hereby repealed.

GRANT MEMORIAL BRIDGE.

IN the House of Representatives, February 7, 1887, a bill for the erection of a national memorial bridge over the Potomac from Washington to Arlington was presented.

Whereas, it is the desire of the people of the United States that there should be erected in honor of its greatest soldier, General U. S. Grant, a monument of imperishable material and of a design suitable to commemorate his distinguished services; and

Whereas, the design most appropriate is a grand monumental bridge, symbolical of the restored Union, across the Potomac River, which divided the North from the South during the tremendous struggle in which the services of General Grant were so conspicuously valuable, leading from the national capital to the sacred grounds of Arlington, where lie buried fifteen thousand men who died for the Union, and to scatter flowers on whose graves thousands go from year to year; therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That a bridge, as a monument to General Ulysses S. Grant, shall be erected across the Potomac River from Observatory Hill, near the foot of New York and New Hampshire Avenues, to such point upon the Virginia shore near Arlington as may be ultimately determined upon by the commission hereinafter provided; and the construction of said bridge, substantially according to the plans submitted to Congress by Captain T. W. Symons, engineer, and Smithmeyer & Pelz, architects, with such modifications and details as may be found necessary or advantageous, shall be in charge of a commission composed of the Secretary of War, the Chief Justice of the United States, the Chief of Engineers United States Army, a member of the Senate to be designated by the President of the Senate, and a member of the House of Representatives to be designated by the Speaker of the House, which commission shall be authorized to proceed with the construction thereof; and the sum of five hundred thousand dollars is hereby appropriated out of any money in the Treasury not otherwise appropriated to commence the construction of said bridge; and the moneys appropriated for said bridge shall be disbursed by the Secretary of War.

SEC. 2. That the Secretary of War shall annually report to Congress, at the commencment of each session, a detailed statement of all the proceedings under the provisions of this act.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE first March meeting of the American Society of Civil Engineers was held on the 2d inst., and was one of the most interesting and important that was ever held. The following gentlemen were elected to membership as named: David Frederic Maxwell, Chief Engineer Government Railways, Province of New Brunswick, Can.; Silvanus Miller, Jr., Chief Engineer for American Contracting and Dredging Company on Panama Canal, Hatfield, Mass.; George Sullivan Morrill, Chief Engineer Old Colony Railroad, Boston, Mass.; George Frederick Simpson, Civil Engineer; John Thompson, Engineer Consolidated Telegraph and Electrical Subway Company of New York. For Juniors: George Herbert Leland, Assistant Engineer, Providence, R. I.; John Muirhead Stewart, Assistant Engineer new Croton Aqueduct; Arthur Smith Tuttle, Assistant Engineer Department of City Works, Brooklyn, N. Y.; Schuyler Skaats Wheeler, Superintendent "C. & C." Electric-Motor Company, New York City. The paper of the evening was by William Metcalf, of Pittsburg, Mem. Am. Soc. C. E., on "Steel: Some of its Properties, its Use in Structures and Heavy Guns."

The author began with definitions, and first as to the use of the word *temper*, showing that it applied to steel unhardened as well as hardened. Unhardened was described as mild, medium, or high steel, and had fifteen tempers, varying in carbon by $\frac{7}{100}$ of a per cent.

He described, also, the various tempers of hardened steel distinguished by color.

Annealing was also described, and he criticised the present gun specifications in this respect.

Iron was described as a liquid with a high freezing point; and he considered steel to be only a variety of iron, having no property that is not common to cast-iron. That from the softest iron up through steel and to cast-iron, the same effects were produced by the same causes; the chiefest disturbers of quality being temperature and subsequent treatment.

Iron, when congealing, slowly crystallizes in *large*, coarse crystals; and when cooled quickly and disturbed while cooling the crystals are finer and more dense.

The effects of carbon in steel are clear and exact, and in the hands of an expert a more exact analysis can be made by an examination of the appearance of the fracture of a piece than can be made by the color-test.

Every piece of iron or steel bears an exact record, where fractured, of the treatment to which it has been subjected; whether chilled, or "scalded," or burnt. Steel is varied greatly in character by the temperature at which it is poured, and Professor Langley has shown that the specific gravity is varied at each difference in structure. For example, a piece of $\frac{53}{100}$ carbon steel varied from 7.844 to 7.818 in specific gravilty, and a bar of 1.79 carbon from 7.825 to 7.690.

Every piece of steel is at its best when in the state called "refined"—that is, in which all strains are relieved, and the grain is fine and uniform—and *such* condition is reached by a proper annealing. Each kind of steel anneals at different temperatures; there is a best heat to harden at, and a best heat to anneal at. All unannealed ingots are brittle; and if annealing be at too high a heat, or carried on too long, the steel becomes worthless.

Since the best results in iron and steel are produced by comparatively quick cooling and by shocks, it is contrary to reason to suppose that the same treatment in a cold state can be detrimental. For this reason he doubts whether continued shock ever deteriorates the quality of the metal.

Hot working increases the specific gravity, and cold working reduces it; cold working, therefore, he considers detrimental to it. Mild steel is tougher, stronger, safer, and more easily produced than iron. He recommends soft steel to engineers for the present, and cautions against rough handling.

Coming to the question of guns, he recommends unqualifiedly the use of the Rodman system of casting around a hollow core with water circulating through it, so that the cooling shall proceed from within, the outside of the mold being warmed. The breech to be cast down, and a high riser to insure solidity of the mass.

All guns to be annealed finally.

He claims for this process all the *good* qualities of the built-up gun, with the opportunity by turning off rings at the end of ascertaining the exact condition of the metal at all times, even after the gun is finished. This can be done by no other system.

Remarks were made by Lieutenant Danenhower, Captain F. V. Green, Commander Robson, Mr. R. W. Hunt, Major Miller, Lieutenant Rogers, and others. Letters were read from Senator Miller and Lieutenant Ingersoll. The continuance of the discussion was postponed to a subsequent meeting.

THE Manure Bill, in the interest of Michael Kane, of this city, has again been introduced by Senator Cullen in the New York Senate. This bill is a very objectionable measure, which has failed to pass several preceding Legistures.

THE Master Builders' Exchange of Philadelphia has secured commodious quarters in the old Merchants' Exchange, Third and Walnut Streets, and is now fitting them up.

AN inspection of the sanitary condition of the State Capitol at Harrisburg, Pa., has been made by Dr. Benjamin Lee, Secretary of the Pennsylvania State Board of Health, assisted by master plumbers of Philadelphia and Harrisburg. A report, with suggestions for alterations, will soon be made.

NEW ENGLAND WATER-WORKS ASSOCIATION.

THERE will be a meeting of the association at Young's Hotel, Boston, on Wednesday, March 9, at 12 o'clock noon. The rooms will be open for members' use at eleven o'clock. Mr. Albert F. Noyes, City Engineer of Newton, Mass., will read a paper entitled "The Driven-Well System as a Source of Water-Supply." Members are invited to prepare to discuss this topic, and to suggest for discussion any others which they may deem of interest to the association.

A SPECIAL meeting of the Civil Engineers' Society of Minnesota has been recently held to consider the factors of safety in test of beams, girders, and piers used in buildings. The architects of the State have a bill before the Legislature prescribing the manner in which buildings shall be constructed. In this bill the engineers desire to incorporate certain amendments which they consider necessary in order to make the proposed law of greater practical value. After considerable discussion a committee was appointed to confer with a committee of architects with a view of preparing an amendment to the bill now pending providing more definite regulations.

THE Canadian Civil Engineers' Society met in Toronto February 24, and elected the following officers: President, T. C. Keefer; Vice-Presidents, Walter Shanly, M. P., Col Gzowski, and J. Kennedy, with a council of fifteen; H. J. Boney is the Secretary-Treasurer.

THE architects of Tennessee organized a State Association at Nashville on February 24, and elected the following officers: President, W. C. Smith; Vice-Presidents, P. J. Williams, J. B. Cook, of Memphis, and J. F. Bauman, of Knoxville; Secretary, T. L. Dismukes, of Nashville; Treasurer, George W. Thompson, of Nashville; Trustees, P. J. Williams, J. L. Smith, Robert Sharp, H. C. Thompson, of Nashville, and R. G. Rosenplanter, of Memphis. The association will meet bi-monthly, and the first annual meeting will take place in Memphis a year hence. The April meeting will be held in Nashville.

AT the meeting of the Bethlehem, Pa., Engineering Society on February 22, Mr. A. L. Colby read a paper on "Tests for Kerosene Oil." Professor C. L. Doolittle presented a paper on "Standards of Measurement," and Mr. G. C. Henning exhibited two standard bars of bronze used for making exact measurements.

PERSONAL.

EX-WATER COMMISSIONER G. W. F. SHERWIN, of Erie, Pa., is preparing a large wall map of the city water-supply. It is made on a large scale, and shows every water-pipe, and the size, every hydrant, with its location, every stop-valve, and every T.

WILLIAM O. SEYMOUR, of Ridgefield, Conn., has been nominated by the Governor State Railroad Commissioner for fours years to succeed Mr. John W. Bacon. Mr. Seymour is a civil engineer.

Patents.

356,254. Method of and Means for Refrigerating Cellars and Vaults. Mathew Leavy, New York. Filed July 13, 1886 Serial No. 207,918. Issued January 18, 1887.

356,258. Apparatus for Making Plumbers' Traps. John McCloskey, New York, assignor to J. Charles Appleby, Jersey City, N. J. Filed August 23, 1879. Issued January 18, 1887.

356,285. Shield for Boiler-Furnaces. William Madden, San Francisco, Cal. Filed May 24, 1886. Serial No. 203,157. Issued January 18, 1887.

356,293. Steam-Radiator. Joseph G. Shearlock, New Haven, Conn. Filed December 18, 1885. Serial No. 186,077. Issued January 18, 1887.

356,318. Pressure-Regulating Valve. Florentine A. Jones, Malden, Mass. Filed May 8, 1886. Serial No. 201,506. Issued January 18, 1887.

356,367. Manufacture of Water-Proof Building-Paper. Israel W. Marshall, Kennett, Chester County, Pa. Filed August 7, 1886. Serial No. 210,296. Issued January 18, 1887.

356,373. Regulator for Feed-Water. Samuel J. Parker, Rochester, N. Y., assignor to Eliza J. Parker, Jennie L. Ross, and Laurie A. Morgan, all of same place. Filed May 1, 1886. Serial No. 200,855. Issued January 18, 1887.

356,392. Hot-Air Furnace. Albert L. Goodenow, Utica, N. Y. Filed May 3, 1884. Serial No. 130,195. Issued January 18, 1887.

356,400. Feed-Water Regulator. Derwin E. Butler, Chesterfield, Fulton County, Ohio; Aurelia O. Butler, executrix of said Derwin E. Butler, deceased. Filed June 24, 1886. Serial No. 206,129. Issued January 18, 1887.

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

No. V.

(Continued from page 318.)

IT is not an uncommon thing where the dolomite and limestone are mixed together, in slabs that have been highly polished, to have the limestone filling between the crystals eaten out by the gases when they are placed in confined places in cities, which leave the dolomite crystals projecting, so that the surface looks as if it never had been polished. An excellent example of the commencement of such decay can be seen in the altar tombstones near the south entrance to Trinity Church, and in the Emmet monument in St. Paul's churchyard.

An extremely curious phenomenon sometimes takes place from the elasticity of limestones, which seems to threaten the immediate destruction of the stone, but which it may resist for a very long time. It is not confined entirely to limestone, but occurs in sandstones as well. This is the bulging of the stone owing to heat applied entirely on one side. From the constant expansion of the surface the crystals seem to assume a certain degree of mobility among themselves, so that the stone bends outward if placed in a vertical position, or sags, if there is opportunity for it, when placed horizontally. This phenomenon has been noticed in some of the public buildings in Europe, but has not attracted much attention here. Having occasion many years ago to examine into the cause of a smoking chimney, I found the opening at the top almost entirely closed by the sagging of the cap, which was a piece of dolomite three feet six inches square and two inches thick. I had it turned over with the bulged side up. In the course of another six months it had commenced to bend in the other direction. The next year it had to be turned over again, and after two or three turnings it finally broke. The heat of the fires on the under side had produced such a separation between the crystals as to cause their movement, and the successive bendings had weakened the stone so that it no longer had sufficient resistance to bear the strain of bending. In buildings the danger of bulging is only that of throwing the stone out, as the expansion is on one side only, and as it can never occur except when the stone is used in thin slabs for facings, can always be provided against by the way in which the stone is fastened into the wall behind it. This same phenomena is often seen in altar tombs where the slab is not sufficiently supported in the centre. It is most common in the coarse granular limestones, or those composed of mixtures of calcite and dolomite. Some such tombs can be seen both in Trinity and St. Paul's churchyards, which are so hollow in the centre, that they hold sufficient water for the birds to bathe in. On most of such stones the inscription has been entirely obliterated. I have sometimes seen sandstones which had laminated in thick layers, from the solution of their binding material, curl away, by the heat of the sun, several inches from the stone behind them, in sheets over eighteen inches wide, and keep bending until they could no longer support their own weight.

Certain conglomerates, which are very hard when extracted from the quarry, undergo a more or less rapid decomposition when exposed to the air. Such conglomerates as these, composed mostly of quartz or limestone grains cemented together by an argillaceous material, are quite frequent in the coal formation, and are, of course, utterly unsuited for building material. There are, however, other limestone conglomerates, notable some of those breccia which are used in the public buildings of Washington, where the disintegration, though much slower, is none the less effective. The beautiful colonnade of the Treasury Department on Fifteenth Street, in Washington, is made of Potomac marble, which is such a material as this. Some years before the war, the disintegration of this stone had progressed so far, that the complete destruction of the colonnade was threatened, so that it became necessary to prevent its extending further. It was coated with paint, and has been carefully protected in this way ever since. It is not generally known that the front of the old Capitol building and also of the White House, which are limestones, commenced to disintegrate so seriously that they were painted some forty years ago, and have been kept painted ever since. The same decomposition is taking place in some of the beautiful marble used in the decoration of the Chapel of Durham Cathedral.

Sandstones are generally supposed to be composed of quartz sand, cemented together by different kinds of binding material, such as quartz itself, as is the case with the Potsdam sandstone; with oxide of iron, as in some of the sandstones of New Jersey and Connecticut; and with carbonate of lime, with or without oxide of iron, as is the case with most of the stone of Trinity Church, and of the ordinary brownstone which is so extensively used in the construction of the fronts of our city houses. In some cases clay is the binding material of the sand, and in others it appears to be some organic compound which easily decomposes.

When the material of which the stone is composed is fine, it is called a sandstone; when it is coarse, it is called a conglomerate. When the pieces are of the size of a hickory nut, and, as is frequently the case, of various colors, it is called a pudding-stone. When the pieces are angular, it is called a breccia. Where such siliceous rocks have undergone metamorphic action, they are frequently changed to quartzites. I have often seen a fine-grained quartz sandstone, under the prolonged action of heat in a furnace, without, however, melting, turned into a nearly

* A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

compact quartz, with a glassy lustre, having very much the aspect of a glazed porcelain. A striking example of this phenomena is in the metallurgical collection of the School of Mines. From a simple inspection there does not seem to be the slightest relation between the stone before and after metamorphism. The stones, however, that are composed altogether of quartz, are of rarer occurrence than is generally supposed. The materials making up the rock are of variable composition, and include a great variety of minerals which seem to have come from previously existing rocks, which have been ground up and subsequently cemented together. In most cases the minerals contained in the stones have retained the characteristic qualities that they had in the original rock. The microscopic bubbles can still be seen moving, as they have been doing since the ages of their formation. The feldspars retain their characteristics, and the fact that the rock of which the sandstone was formed was sound, or was undergoing decomposition at the time of its destruction, may still be seen in the sandstone.

The structure of the stone is very different, not only from the different kinds and sizes of the grains which compose it, but also according to the greater or less amount of pressure exerted at the time of its formation. In some, the consolidation is so loose that they are manifestly unfit for constructive materials; in others, there is every degree of real or apparent compactness. In order to fix a rule, it has been stated that those stones which, in a climate like our own, effervesce slightly with acids, which weigh less than 130 pounds to the cubic foot, and which absorb in the course of twenty-four hours over five per cent. of water cannot be good stones. Many of our sandstones, after having been exposed to the weather for a considerable length of time, will absorb anywhere from three to fifteen per cent. of water in twenty-four hours, and consequently stand but a short time in a building.

When sandstone, which has a laminated structure, is not placed in its quarry-bed, it is impossible that it should stand in the building for any great length of time, unless the binding material is quartzose. Sooner or later from the effects of the weather, lamination will take place, and this may be seen in most of the sandstone pillars so common on the fronts of houses in former days, and on some of the ornamentation of the beautiful entrance to Greenwood cemetery, which is being rapidly destroyed in some of its upper parts by this cause, as well as decomposing from other causes in other parts of the structure.

Decomposition occurs most rapidly in those sandstones having organic or argillaceous binding materials. The former are decomposed by the weather, the latter very rapidly swell and disintegrate the stone, and very soon obliterate all traces of moldings. Those having a ferruginous gangue are more suitable unless the iron has come from the decomposition of pyrites, in which case the excess of sulphur renders the stone likely to disintegrate. In some cases the causes which have produced the precipitation of the iron, which binds the sand together, have acted very unequally, so that the stone is hard in some places and soft in others, and consequently resists the action of pressure unequally in different parts.

Most of the New Jersey sandstone has either an argillaceous or calcareous binding material. Both are easily acted upon by the weather in the country and by the gases of the city, especially at points near the ground, or where the moldings are improperly cut, so that the water is not shed from, but remains on or filters through them. Examples of this may be found in almost every street in large cities where brownstone is used. The same kind of decay may take place at or above the level of the ground from a different cause. If the superstructure has not been provided with a damp-course, the moisture will rise in the masonry as high as 8 or 10 feet, the effect being the more prominent as the walls are thicker. If, in addition to this, the surface drainage is toward the building, instead of away from it, the quantity of moisture will be all the greater. Exactly the same effect is produced when the water from the roof is not absolutely cut off from the vertical walls of the building. In old buildings little or nothing was done to prevent this action except the drainage of the foundation. When the foundations were properly drained, and the stone used in them had a siliceous cement, the bad effect was exceedingly limited in extent, and did not usually show itself until after a long period of years. When, however, the stone was a limestone, or had a calcareous binding, this was slowly but surely dissolved out, the effect being all the more rapid as the locality was more densely populated. In order to prevent this action, the outside of the foundation-walls against the earth is covered with asphalt, and what is called a damp-course is frequently made by spreading a thin layer of asphalt over the horizontal surface of the wall above the ground so as to prevent the water from passing up into the walls of the building. If there is no protection from dampness, as in most old buildings, and the situation is a moist one, there is then another difficulty which hastens the decomposition of the stone, which is, that on the north side the stone is uniformly moist, while on the south side it is from its greater exposure to the sun, dry and moist alternately. As the moist side is already near its point of saturation it sheds the water, while that which is dry absorbs and then sheds it, carrying some soluble material with it.

When in sandstones the binding material is oxide of iron, there is frequently only just enough of it to hold the sandstone together, so that the least decomposition will cause the stone to disintegrate. Such stones as these, where there is a minimum quantity of binding material, are always rapidly decomposed when subjected to atmospheric influences.

(TO BE CONTINUED.)

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK CITY.

47 Orchard st, five-story and basement Philadelphia br ten; cost, $19,000; o, Isaac Marks, 175 Clinton st; a, Fred Ebeling.

809–811 Broadway, 5-story warehouse; cost, $55,000; o, Robert Goelet, 591 5th av; a, J. M. Dunn; m, M. Reid.

304 W. 21st st, 5-story Philadelphia br ten; cost, $19,000; trustee, Moritz Herzberg, 135 Allen st; a, F. Ebeling.

150–152 E. 27th st, two 6-story br ten; cost, each, $23,000; o, Salomon Jacobs, 195 East Broadway; a, Schneider & Herter.

206 W. 41st st, 6-story Philadelphia br with stone trimmings ten; cost, $20,000; o, M. Rinaldo, 220 E. 33d st; a, Charles Rentz.

10th av, n w cor 40th st, two 5-story Philadelphia br ten; cost, corner $30,000, inside $20,000; o, David Stevenson, 224 W. 46th st; a, Geo. Keister.

76th st, s w cor 4th av, 5-story br stable; cost, abt, $40,000; o, a and b, Edward Kilpatrick, 29 E. 80th st.

115th st, n s, 66 w 2d av, 1-story stone stores; cost, $800; o, Michael J. Irwin, 247 E. 115th st; a, J. H. Valentine.

2d av, n w cor 102d st, 5-story b s stone stores and ten; cost, each, $16,000; o, Susannah Osborne, 1753 Av A; a, J. H. Valentine.

102d st, n s, 79 w 2d av, 5-story b s stone ten; cost, $18,000; o and a, same as last.

73d st, s s, 275 w 1st av, four 5-story br ten; cost, each, $16,000; a, J. N. Gault, 210 W. 53d st; a, Will Alan O'Hea.

84th st, s s, 305 e 3d av, two 5-story br and b s stone tens; cost, each, $18,000; o, Patrick McMorrow, 413 E. 83d st; a, A. B. Ogden & Son.

518 E. 86th st, 5-story br ten; cost, $14,000; o, Louis Milaster, 641 E. 11th st; a, Jobst Hoffmann.

122d st, n s, 100 e Madison av, 4-story br workshop and factory; cost, $9,000, o, Henry Riehl, 240 W. 29th st; a, Will Alan O'Hea; b, George Healing.

64th st, n s, 25 w 9th av, 11 4-story and basement b s stone dwells; cost, each, $18,000; o, Leonard Beeckman, 228 E. 82d st; a, Geo. M. Walgrove.

72d st, n w cor 9th av, 6-story br and stone store and office building; cost, $120,000; o, a and b, Chas. Buek & Co., 500 Madison av.

72d st, n s, 75 w 9th av, 4 4-story and basement br and stone dwells; cost, one $35,000, two $30,000 each and one $28,000; o, a and b, same as last.

10th av, e s, 87 s 103d st, 3 5 and 2-story stores and tens; cost, $17,000, dwells, $3,000; o, Frederick Schmidt, West Boulevard and 88th st; a, George Matthias.

98th st, s s, 74 w 9th av, 5-story br and b s stone ten; cost, $16,000; o and a, same as last.

7th av, s e cor 130th st, 5-story Philadelphia br ten; cost, $18,000; o, Franklin A. Thurston, 62 E. 133d st; a, R. S. Townsend; b, not selected.

7th av, s w cor 132d st, 5-story Philadelphia br ten; cost, $18,000; o and a, same as last.

10th av, w s, 24.11 s 146th st, 3 5-story br, b s stone trimmings, tens; cost, each, $18,000; o, a and b, William Fernschild & Son, 2183 4th av.

Fulton av, e s, 200 n 179th st, 2-story and attic dwell; cost, $5,000; o, C. L. Schwarz; a, Theo. E. Thomson, n e cor 125th st and 8th av.

40-46 Delancy st, 4 br ten and stores; cost, $76,000 all; o, Harris Cohen; a, William Graul.

148 Lincoln st, br ten and store; cost, $8,-000; o, James Parker and M Corat; a, J M Dunn.

665 E 148th st, fr ten; cost, $5,000; o, Jac H Doen; a, Beyer & Boylis.

S e cor 3d ave and 96th st, br flat and store; cost, $25,000; o, M Gibbin and J W Taylor; a, Max Hensel.

S s 96th st, 100 ft e of 3d ave, 4 flats and stores; cost, $60,000 all; o, M Gibbins and J W Taylor; a, Max Hensel.

BUILDING INTELLIGENCE.

NEW YORK CITY.—Continued.)

S s 92d st, 261 ft w of 8th av, 8 br dwells; cost, $144,000 all; o, Dore Lyro; a William H Boylan.

538-40 W 37th st, br factory boiler-house; cost, $6,000; o, Rohe & Bro; a, Thom & Wilson.

S w cor 4th ave and 118th st, 2 flats and stores; cost, $35,000 all; o, Charles McCloskey; a, J H Burrows.

S s 118th st, 90 ft w of 4th ave, 2 flats; cost, $34,000 all; o, Charles McCloskey; a, J H Burrows.

162-8 Green st, 3 br and iron stores; cost, $80,000 all; o, Leon and Emanuel Mandel; a, Cleverdon & Putzel.

S w cor 89th st and 9th ave, br flat; cost, $45,000; a, Augustus Brakmann; a, Stent, Dixon & De Saldens.

307-9 E 39th st, 2 br tens and stores; cost, $28,000; o, George Ott; a, Armand Wirz.

270 E 78th st, br store and dwell; cost, $16,-000; o, August Jacob; a, Thom & Wilson.

N s 122d st. 200 feet w of 7th ave, 2 br dwells; cost $15,000 all; o, Mary E Tate; a, George H Budlong.

635 E 149th st, br dwell; cost, $14,000; o, George Koehler; a, Adam Munch.

8-10 Dutch st, 2 br stores and factory; cost, $11,000 to $12,000; o, Colgate & Co; a, William Howe.

ALTERATIONS, NEW YORK.

59–61 Wall st, add 3 stories, also int alt; cost, $75,000; o, estate Jas. Brown, on premises; b, not selected.

437 W 25th st, br ten; cost, $5,000; o, b, and a, John Geagan.

154 Water st, office and dwell; cost, $6,000; o, August Schacht; a Berger & Baylis.

S s 68th st, 125 ft e of 4th ave, Home for the aged; cost, $25,000; o, Baptist Home for the aged; a, D & J Jardine.

520-22 W 24th st, br factory; cost, $9,000; o, Fred S Myers; a, George W Budlong.

163-65 Attorney st, 2 br tens; cost, $22,000 all; o, Fred Greis; a, Ernest W Greis.

BROOKLYN.

Herkimer st, n e cor Nostrand av, 5 3-story and basement br stone dwells; cost, each, $7,000; o, James O. Carpenter, 120 New York av; a, G. P. Chappell; b, not selected.

W s Bancroft pl, 117 ft s of Herkimer st, 2 fr dwells; cost, $7,000 all; o and b, Adolph Sussman; a, H Vollweiler.

E s Prescott pl, 117 ft s of Herkimer st, 2 fr dwells; cost, $7,000 all; o, a, and b, same as last.

S w Hamburg av, 100 ft n of Melrose st, fr dwell and store; cost, $5,000; o, F Pfeifer; a, H Vollweiler; b, John Wagner.

S s S 9th st, 100 ft e of Driggs st, br dwell; cost, 15,000; o, J H Dick; a, E F Gayler.

N s 3d av, 172 ft e Hoyt st, br bldg; cost, $15,000; o, Geo D Powell; a, John W Baily.

N s Liberty av, 60 ft e of Alabama av, 5 fr dwells; cost, $12,500 all; o, Mrs M Estel; a, Frank Holmberg.

200 Floyd st, fr ten; cost, $6,500; o, J Kissler; a, H Vollweiler.

N s Greene av, 434 ft e of Central av, fr church; cost, $7,000; o, German Mission Church; a, C J L Johnson.

N s 2nd st, 81 ft e of 5th av, 28 br dwells; cost, $140,000 all; o, Hagedon Squance; a, F T Camp.

834 Prospect pl, br dwell; cost, $10,000; o, Wm Macbeth; a, Agustus Howe, Jr.

960 Kent av, ten; cost, $6,000; o, W H & G A Maily; a, A B Porter.

171 Lefferts pl, fr bldg; cost, $12,000; o, John Milligan; a, Geo P Chappell.

516 N 2d st, fr factory; cost, $5,000; o, Thos R Sheffield; a, Th Engelbardt.

N w c Manhattan av, cor Noble st, br savings bk; cost, $8,000; a, W H Gaylor.

MISCELLANEOUS.

ALLEGHENY, PA.—Alslon & Heckert, architects, have closed contracts as follows: William Chesholm, contractor, takes the C. D. & P. Telegraph Company at $31,149 and R. J. Graham, contractor, takes James Harrocks buildings at $5,155.

BUILDING INTELLIGENCE.

ALLEGHENY, PA.—The Allegheny I Company has begun work on their $5 building at the corner of South Diamo Sandusky sts.

BONNE, MICH.—A new church will be here by the Catholics of this place and edonia,

BROOKLYN. — The German Meth Church will build on Green av, bet Central and Evergreen Avenues, Willi burg.

BROOKLYN, N.Y.—Plans by C C Ha of New York, for the new hall of Adelphi Academy have been accepted by Trustees.

BOSTON, MASS.—Address the New E land Malt Company in regard to new bu ings, machinery, etc., to be built on Wi sor st, in Cambridge and Somerville.

(Continued on page 353.)

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 15. } PUBLISHED EVERY SATURDAY.

NEW YORK, MARCH 12, 1887.

LONDON, MARCH 26, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. } IN AMERICA.

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

WATER BACTERIA.

A VERY large part of practical public hygiene of the present day is devoted to the providing of pure water-supplies and to the making it inconvenient and difficult to use polluted water. The possibility of doing this certainly, constantly, and economically depends upon our knowledge as to what impurities are dangerous to health, and as to how these impurities can best be prevented or gotten rid of. We have learned that among the most dangerous forms of water impurities are certain bacteria, but that all natural waters contain certain other kinds of bacteria which are harmless, even if they are not actually beneficial. These last are what the German bacteriologists call "*wasser bacterien*"—*i. e.*, water bacteria—by which they mean, not by any means all bacteria which may be found in water, but those bacteria which are usually found there, and which, under ordinary circumstances, produce no ill effects on those using the water. There are several different kinds of these water bacteria, some of which only appear at certain seasons, some of which produce bluish or red pigments, and which are distinguished by the effects which they produce in or on various culture media, such as gelatin, sugar, milk, potato, etc. Some of them will grow and multiply not only in what is ordinarily termed pure water, but in water that appears to chemical tests to be absolutely pure, in freshly distilled water, in which it would seem impossible for them to find food for their support.

They are found not only in surface-waters, but also in deep well-waters, though in very small numbers, and present many curious problems to the investigator. One of the most interesting and important of these problems is as to the influence which they may exert upon other and more dangerous organisms which find their way into their presence.

In some way or other the disease-producing bacteria disappear; the epidemic of anthrax or cholera or typhoid comes to an end; there are, as Dr. Buchanan says, forces of nature which oppose the multiplication of the specific germs of disease, and the future aim of sanitary science will be to make use of these forces. Among these forces it seems very probable that one of the most powerful is the agency of other bacteria, which produce what we call the "self-purification of rivers," by destroying those which are more harmful.

The great majority of the disease-producing bacteria while in the stage of active multiplication and development appear to have less tenacity of life and to be more easily destroyed than the harmless forms, and this should be the case, since we may presume that the forms most commonly found are those best suited to succeed in the struggle for existence, and are best adapted to the conditions presented in ordinary natural waters.

It is, however, a question whether some of the common harmless forms of water bacteria may not become dangerous when large quantities of organic matter suitable for their nourishment are added to the waters which contain them, either because great numbers of them may produce effects which a few cannot, or because peculiarities of food-supply and temperature may change radically their character and products.

In any case it is very certain that careful and long-continued study of the life-history of the harmless water bacteria is essential for the progress of the science of hygiene, and there is little doubt that in the course of such study many discoveries will be made which will bear not only on disease-prevention, but upon agricultural and manufacturing interests as well.

WATER-WASTE, WITH SPECIAL REFERENCE TO BROOKLYN.

MR. PETER MILNE, ex-Water Purveyor of Brooklyn, recently delivered a very interesting and instructive address to the members of the Oxford Club of that city regarding the water-supply of Brooklyn. He was entirely right in maintaining that the embarrassment of a short supply which constantly meets all growing communities can never be adequately overcome until there is a radical change over the present methods of locating and fitting up water-supply pipes within buildings. The enormous waste which is due to the running of water from open faucets in cold latitudes six months out of the year, because the pipes and fixtures are located where the water is certain to freeze, and the leaking of improperly constructed apparatus twelve months out of the year, is due to the fact that there is no intelligent control of the character of the fittings used and to the way they are fitted up.

As Mr. Milne points out, it might not be practicable to attempt too much interference by municipal authorities in cities like Brooklyn with the details within occupied houses. In such an event the meter is the only resource, for that would in time deter the householder from recklessly wasting water which he knows he will have to pay for. But in all large cities this is hardly enough, since this will only operate to make a householder take care of the apparatus that he may have in use. The root of the matter is the location of plumbing in buildings, which should be controlled by the authorities when new work is being constructed. That is to say, plans should be filed, as required in the case of drainage, and when, in the judgment of competent persons, the location of pipes and fixtures is such as to insure their freezing in the winter months, such plans should be rejected and the plan modified to secure the needed protection. In other words, such care should be taken in the matter as is now exercised by the Health Department of this city and Brooklyn over the running of drain and waste pipes. Until that is done, even though meters are universally used, the householder, often through ignorance and frequently through causes beyond his control, will be compelled to pay for the water he wastes, which waste he would not be obliged to permit if the water-pipes in his building were in the first place properly located with reference to the possibility of freezing. In large cities the occupants of houses in the great majority of cases are only tenants, and, besides not being responsible for the location of pipes and fixtures in the buildings they occupy, would often find it cheaper to pay for water wasted than to incur the expense of remodeling the water-supply system of the buildings they occupy.

AMENDED U. S. RULES FOR STEAMBOAT BOILER TESTS.

ELSEWHERE in this issue will be found the amended rules relating to tests of boiler-plates adopted at the late annual meeting of the Board of Supervising Inspectors of Steam-Vessels, held in Washington, January-February, 1887.

It is to be regretted that the bending test was not called for, particularly in the selection of

steel plates for boilers. The tensile strength test for steel plates without limit of strength—say 65,000 pounds—is wholly inadequate. Nothing is said about the elastic limit or elongation or reduction of area before breaking, and under the rule, as it stands, steel even if run up to 100,000 pounds tensile strength and snapped like glass at the strain the local inspector would have to accept it. Of course, "homogeneousness, toughness, and ability to withstand the effects of repeated heating and cooling" are alluded to, but what under this law is to be considered "toughness" we are at a loss to know.

NEW PAVEMENTS FOR NEW YORK.

IT is reported that a movement is on foot to secure legislative authority to repave a large number of streets in this city, the work to be under the control and direction of General Newton, Commissioner of Public Works. We hope it may be successful. THE SANITARY ENGINEER AND CONSTRUCTION RECORD has for some time been printing articles describing notable examples of pavements in other cities, and a person only needs to read these, even if he has not an opportunity of visiting other cities, to become convinced of the wretched character of the pavements of this great city. If authority is granted General Newton's department to construct these pavements, and there are no needless conditions inserted in the act to tie the Commissioner's hands, we believe New York City will secure good pavements and at a moderate price. But these good pavements cannot be maintained unless additional powers are granted to the Department of Public Works, which will prevent in future any disturbance of them, except by the servants of this department, and under its direction, such disturbances to be paid for by the companies, whoever they may be, in whose behalf the pavements are taken up. This city badly needs pavements, but if it is to retain any worthy of the name, after they are laid, some check must be placed upon the gas, steam, and electric-light companies, who would otherwise keep them in a constant state of eruption.

THE New York Board of Health has at last been relieved from the embarrassment of having General Shaler as its president. Governor Hill, after a tardiness which he unsatisfactorily explains, has finally consented to his removal. Before this decision was made public the District Attorney moved that the indictment pending against General Shaler for bribery in connection with the purchase of armory sites when he was a member of the Armory Board, should be dismissed, which was done, and was probably the best thing under the circumstances, since it will be remembered two trials resulted in a disagreement of the jury. It is to be hoped that the gentleman whom Mayor Hewitt will appoint will be such as to secure a return of the public confidence in the board and restore its efficiency.

OUR BRITISH CORRESPONDENCE.

Sir Robert Rawlinson on Good Sewerage Systems in English Towns—Disputes over the Ventilation of the Underground Railway—Suitable Materials for Telephone Wires—A Wooden Tower 900 feet high.

LONDON, February 23, 1887.

SIR ROBERT RAWLINSON, C. B., speaking at the dinner of the Association of Sanitary Inspectors, stated that he knew of towns in England of 100,000 inhabitants so completely sewered that no sewage remained in the place for 24 hours, and others of smaller population which got rid of their sewage in less than three hours. Such places are veritable cities of Hygeia, and it is a pity Sir Robert did not name them, for the benefit of the holiday-seeker desiring health.

The efficient ventilation of the Underground Railway is a perpetual *casus belli* between the Metropolitan Railway Company and the Metropolitan Board of Works. The railway has promoted a bill in the present Parliament for power to purchase lands and houses for the better ventilation of their stations and lines. The Metropolitan Board has petitioned to be heard against the bill. It is very difficult to understand the *raison d'être* of the opposition offered whenever the railway makes any such move. The atmosphere of the "ways" on a sultry or damp day is even now sulphurous, in the section, say, between Charing Cross and Mansion House, and thence in a lesser degree to Gower Street. It is, however, unquestionably improved on the first-named since the erection of the ventilators on the Embankment some two years since. These ventilators are simply brick shafts, about 9 feet high by 40, opening that height above the gardens on the Embankment. At the time of the erection of these there was very considerable agitation, and it was prophesied that both the people and plants in the gardens would be damaged by the escaping fumes. Neither people nor plants have apparently suffered, while the additional comfort to the railway passengers is unquestionably great. It is therefore very difficult to understand what end can possibly be sought by the Metropolitan Board in seeking to "bottle up" the obnoxious fumes from the engines, etc., in the covered ways; the alternative they suggest being that the railways should be ventilated into the Thames.

Examinations of the telephone wires in Germany after a recent heavy snow-storm bring out the fact that steel wires show favorable results for strength and durability, but those of silicum bronze are even superior, while those of phosphor bronze are, comparatively speaking, no good.

In demonstration of the progress of the art of building in wood during the last century, a wooden tower over 900 feet high is to be erected for the Brussells Universal Exhibition next year. The engineers of the structure are, MM. Hennebique & Nève; the cost is to be £80,000 ($384,000). The tower will have a pyramidal base, area 3,000 feet, surmounted by a spire, and will be divided into three galleries. The basement will consist of concert and refreshment rooms, etc., the next gallery a belvidere, with terraces, the summit being an observatory. The absence of storms of wind during the existence of the said tower is to be hoped for.

SAFETY VALVE.

A COTTAGE AT CUSHING'S ISLAND, ME.—CLARENCE. S. LUCE, ARCHITECT.

OUR SPECIAL ILLUSTRATION.

THE GRANT MEMORIAL BRIDGE OVER THE POTOMAC RIVER.

OUR illustration shows the bridge proposed to be built over the Potomac River at Washington in memory of General U. S. Grant, which we referred to in our last issue and then promised to illustrate. The design is the work of Captain T. N. Symons, U. S. Engineers, and Messrs. Smithmeyer & Pelz, architects, of Washington.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

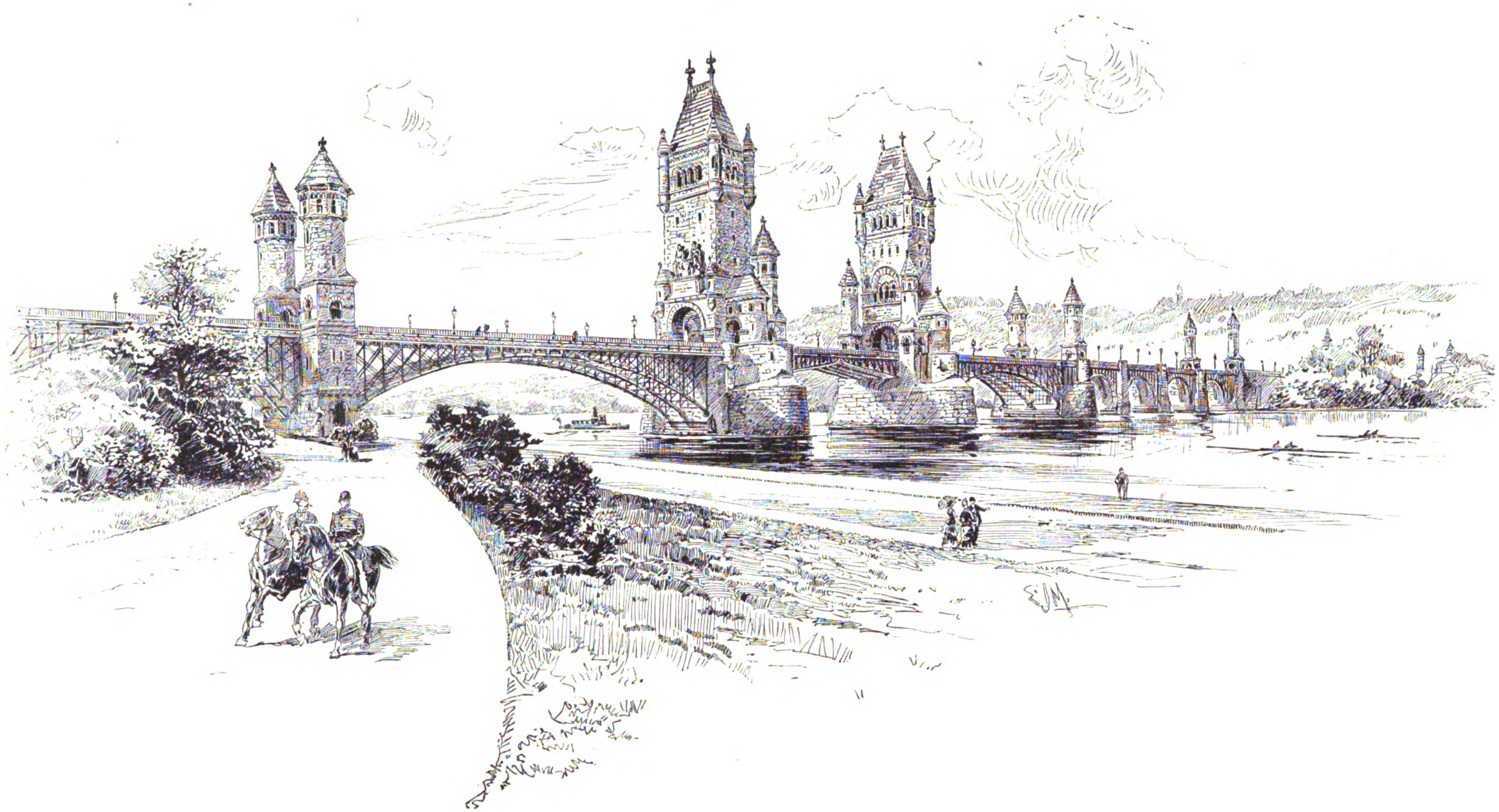
COTTAGE AT CUSHING'S ISLAND, ME.—CLARENCE S. LUCE, ARCHITECT.

OUR illustration shows a house located at Cushing's Island, Me., erected at a cost of $2,300. The material used is stone boulders. Clarence S. Luce was the architect.

OUR SHEET OF DETAILS.

OUR Detail Sheet, the seventh in the series, shows the doorway of the Hemenway Building in Boston. Bradley, Winslow & Wetherill were the architects.

THE Toronto Architects' and Draughtsmen's Branch of the Canadian Institute had a meeting February 28, with a paper by Mr. H. Langley on "Hints to Young Architects."

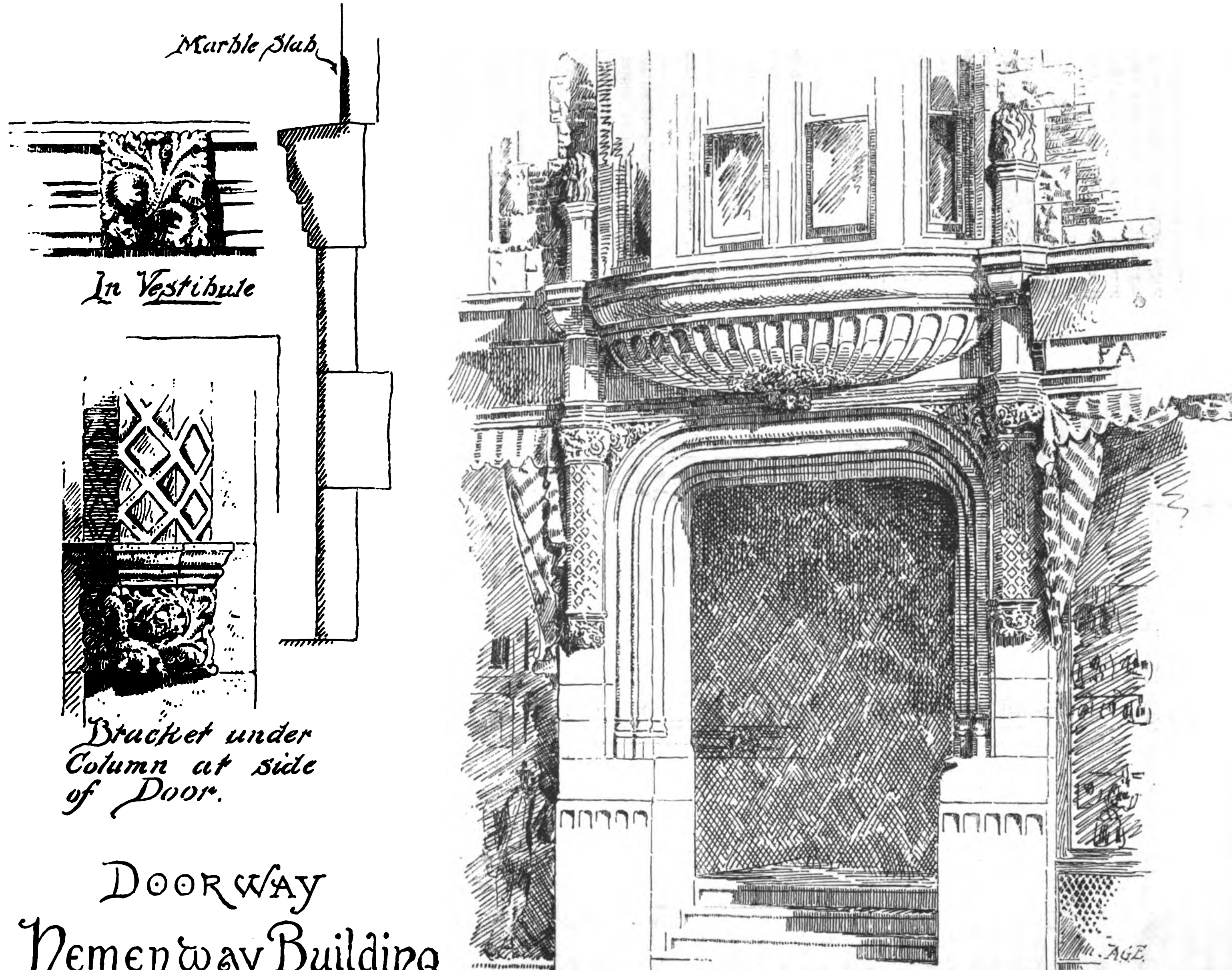


THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

PROPOSED MEMORIAL BRIDGE TO GEN. GRANT OVER THE POTOMAC RIVER BETWEEN WASHINGTON AND ARLINGTON.

DESIGNED BY

CAPT. THOMAS W. SYMONS, CORPS OF ENGINEERS, U. S. A., AND SMITHMEYER & PETZ, ARCHITECTS.



DOORWAY
Hemenway Building
Bradley, Winslow & Wetherill Arch'ts Boston.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XIV.

(Continued from page 345.)

As this series of articles is to cover a wide range of engineering practice, it will become necessary at times to describe patented apparatus where it has been adopted in special cases and seems to be well fitted for the work in hand. With this explanation we give in our present article a description of the "Cram steam pile-hammer."

We do this not because the application of steam directly to the hammer is new, for the Nasmyth hammer has been known and widely used for many years. Our object is rather to call attention afresh to the unquestionable superiority of this method of pile-driving over that where the hammer falls a long distance and gives the infrequent, battering blows so almost universally employed, and which split the piles without causing penetration. After the steam-hammer begins operation, on the contrary, the blows are so rapid (70 to 100 per minute) that the earth once distributed has no time to settle, and the pile sinks through it in somewhat the same manner as it would when the earth is loosened and held in suspension by a water-jet.

The operation of the machine may be best understood after an examination of the accompanying figures.

Figure 53 is a part general view of a scow pile-driver, with the machine lowered and resting on a pile.

Figure 54 is a rear elevation of the machine, showing the valve-tripping apparatus, also a sectional plan on line A A.

Figure 55 is a central vertical section on line B B.

Figure 56 is a side view, also a section on C C.

In use the whole apparatus slides on a pair of ordinary ways, or "leaders," being raised or lowered by means of the bail (*s*).

When ready for use, as shown in Fig. 53, the hammer is at the bottom of the frame, the piston-head being at the bottom of the cylinder and resting on the spring (*u*). These serve to catch any chance blow and prevent injury to the foot-block (*j*). The hammer-head, of course, projects through the orifice (*k*) in the foot-block, and as much as the pile-head enters the orifice, so much is the hammer-cylinder pushed up, so that its whole weight rests on the pile.

On the admission of steam through the flexible hose attached to the inlet (*t*), it passes through the piston-rod into the cylinder (*g*), the hammer slides upwards in its frame *a b j* to the extent of its stroke (or about 40 inches for a large machine); then the steam is exhausted through the tripping of the vaive, and the hammer falls giving a free blow. The upper trip at once admits steam, and the operation is quickly repeated.

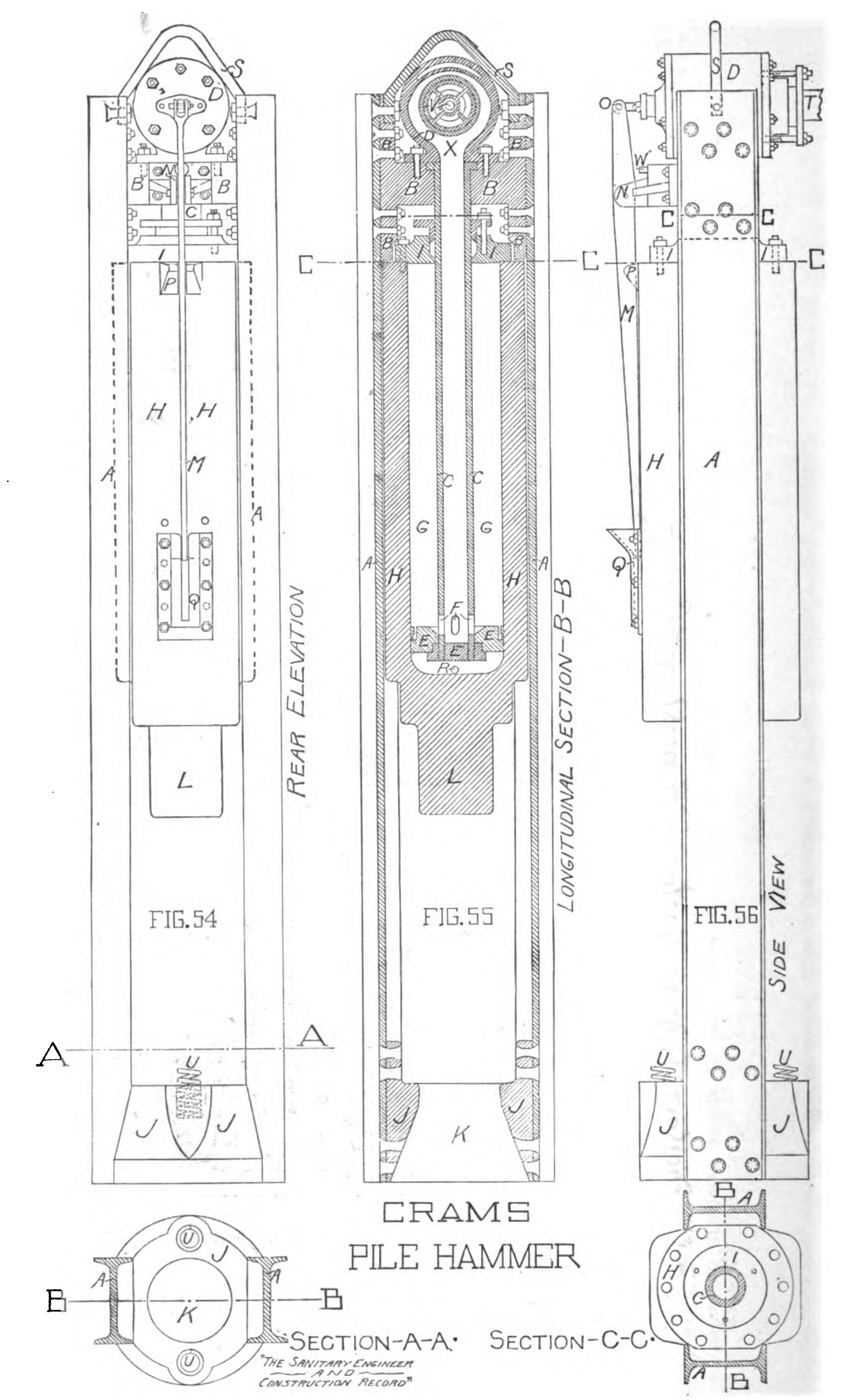
Figure 57 shows details of the valve and steam-chest.

The valve itself is shown in end projection at A, and side projection at B, and is a hollow cylinder, with open ends and a ring *y* cast around its periphery, with a slot *z* cut through its shell near the ring, and with the socket by which it is held upon the valve-stem supported by four radial webs (1) extending the length of the valve and attached to its shell. The jamb-nuts (2) hold it firmly upon the valve-stem where the valve is shown in place in section of steam-chest (*d*) between lines V V. The upper wall of the steam-chest at 3 is made hollow to preserve equal thickness of metal for uniform expansion, etc., and is connected by openings (4) with interior of steam-chest, so that steam finds constant admission and can circulate from end to end of steam-chest in this way as well as through the hollow valve.

The cylindrical box (5) is cast so as to surround the valve, and connects, first, through slot 6 with the opening 7, which joins the hollow piston-rod leading to the hammer cylinder, and, second, with the exhaust orifice 8 through 9, which opens to the air. The tongue (10) separates the box into two portions used for exhaust and supply respectively, each of which has an annular slot (8 and 6) through the steam-chest shell surrounding the valve-shell.

It will be noticed that the only steam-pressure on the valve is outward from within the cylindrical valve-shell and can exert no influence toward producing friction. In other words, the valve is so perfectly balanced that it works readily whether with or without steam supplied.

In the drawing, the valve is slid out, or as it would be thrown by the trip *q* acting upon the lever *m* when it is ready to fall. In other words, the steam is being exhausted as the ring *y* straddles the two slots 6 and 8, and steam from within the hammer cylinder finds vent up the hollow piston-rod and out the exhaust-port (9).



REFERENCE LETTERS.

a a. Ten-inch I-beams forming the sliding frame within which the hammer *h l* slides.

b. Cross-girder riveted to the upper ends of the I-beams (*a*) by means of which and the bail (*s*) the whole apparatus is raised or lowered for adjustment to the head of the pile.

c. Hollow piston-rod hung loosely on a collar through a hole in the cross-girder (*b*).

d. The steam-chest, supported by the cross-girder (*b*) and covering the opening of the piston-rod (*c*).

e. Piston-head and plug of the end of the hollow piston-rod (*c*).

f. Steam openings in the hollow piston-rod (*c*) through which steam passes to the space (*g*) surrounding the rod.

g. Annular space (between the piston-rod and the interior of the hammer) which forms the steam-cylinder.

h. Hammer cylinder.

i. Cylinder-cover with stuffing-box.

j. Foot-block or bonnet casting riveted to the lower ends of the I-beams and forming the lower part of the sliding-frame.

k. Conical opening through the foot-block (*j*) shaped to receive the head of the pile.

l. Cylindrical prolongation of the hammer-cylinder (*h*), forming the hammer-head.

m. Lever which works the steam-valve.

n. Fulcrum for the lever (*m*) bolted to the face of the girder (*b*).

o. Attachment of the lever to the valve-stem.

p. Upper trip, which throws the valve-stem in and supplies steam to the cylinder (*g*).

q. Lower trip, which throws the valve-stem out and exhausts the steam. (*p* and *q* are both attached to the hammer-cylinder.)

r. Vent for air and condensed water.

s. Bail by which the whole machine is lifted.

t. Connection of steam-hose with steam-chest.

u. Springs to guard foot-block.

v. Balanced steam-valve.

w. Set-screw regulating travel of steam-valve.

x. Mouth of steam-chest (*d*).

The complete action is then: The hammer falling, the valve is thrown so the slot *z* cove s 6, while the exhaust-slot 8 is covered by metal. The steam from steam-hose connection *t* through the hollow valve-slot, *z*, 6 and 7, and hollow piston-rod finds admission to the interior of the hammer, which causes it to rise until the lever throws out the valve and steam is exhausted as before.

The hammer-cylinder weighs 5,500 pounds, and with 60 to 75 pounds steam gives 75 to 80 blows per minute. With 41 blows per minute a large unpointed pile was driven 35 feet into a hard clay bottom.

The steam-valve has a travel of five-eighths of an inch in a steam-jacketed chest. The length of its movement is adjustable, so as to suit the force of the blows to the work in hand.

The following examples of the work performed are sent us by the builders of the machine, and we have no reason to doubt their correctness.

Piles driven in the Saginaw River as far as a drop-hammer (2,500 pounds falling 40 feet) could drive them were readily driven farther down by this machine.

On the Mississippi River near Wilson's Point, La., piles driven by Government authorities through the combined use of jet and drop-hammer, requiring 1 hour and 40 minutes, were also readily driven farther. Other piles in the same place were wholly driven by the steam-hammer in less than five minutes.

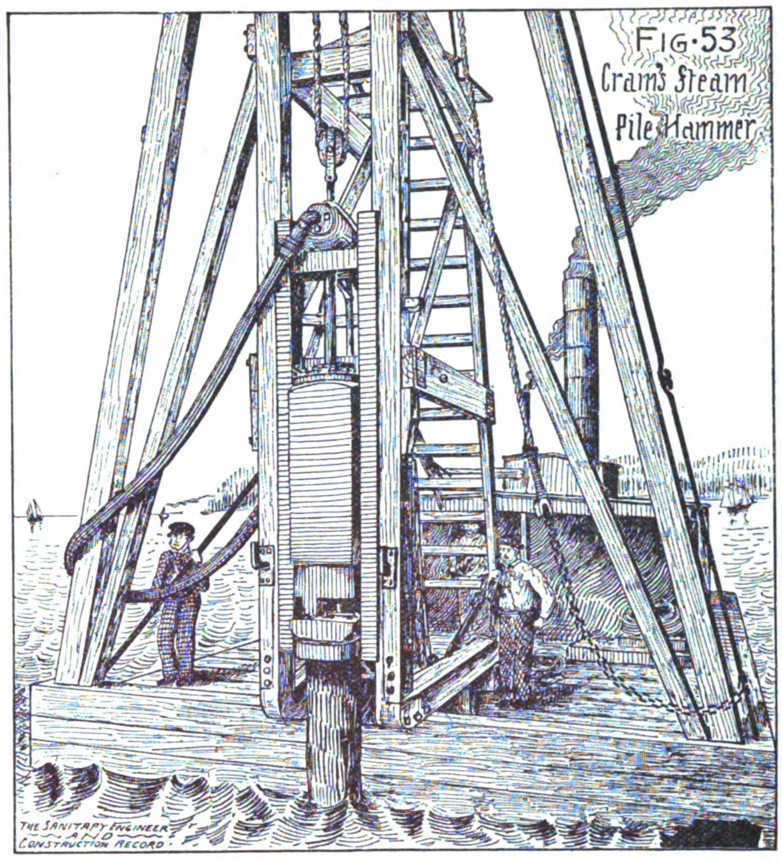
Quoting from a letter written by the contractor constructing the Belt Line Bridge foundation at Cleveland:

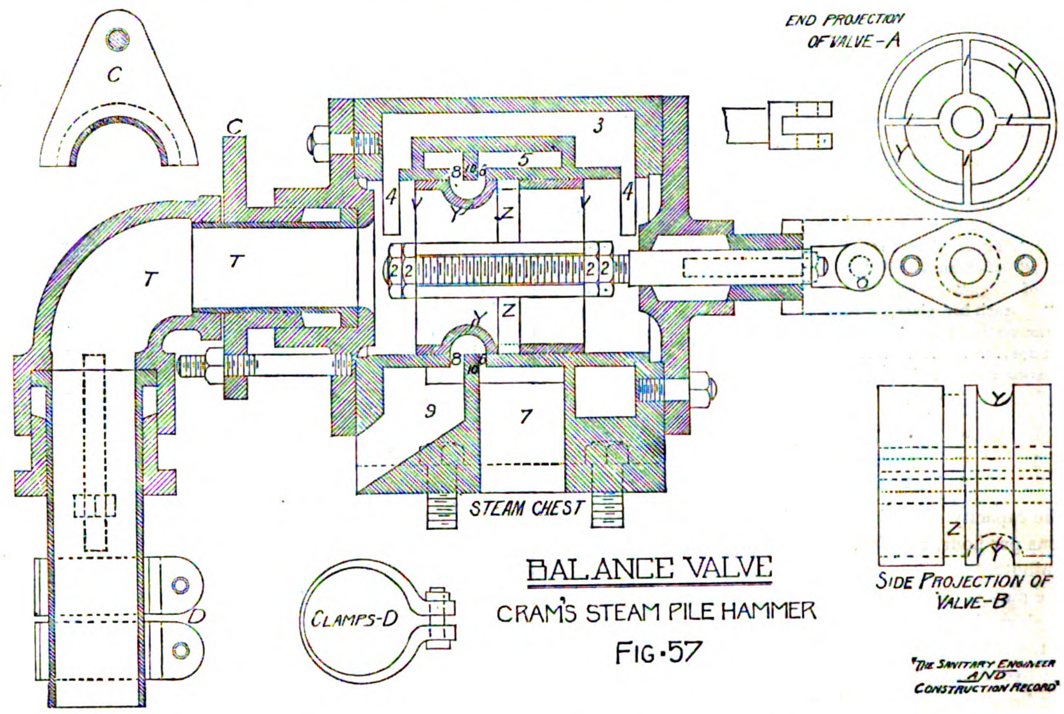
"I have driven over 1,000 piles from 50 to 62 feet long and 10 inches and over in diameter at the point. None were bruised or split. The first four piles were driven with a drop-hammer and three of them were split. Without the steam-hammer we could not get the piles driven according to contract '30 feet into solid ground.' It takes from 3 to 10 minutes to drive each pile."

It was contemplated by those performing the recent extension of the Cambridge City Water-Works that in constructing a dam where it was necessary to drive 8-inch sheet-piling through quicksand and gravel, it would be necessary to use the jet with whatever pile-driver was employed. These piles were driven satisfactorily and expeditiously by the Cram pile-driver, without the use of a jet.

The builders and patentees are Messrs. R. J. & A. B. Cram, of Detroit, Mich.

(TO BE CONTINUED.)





BALANCE VALVE
CRAM'S STEAM PILE HAMMER
FIG·57

LAWRENCE, MASS., WATER-WORKS.*

ALTHOUGH but forty years have elapsed since the first dwelling was erected in Lawrence, which to that time had been a wilderness, the town did not grow to its present proportions with forty thousand inhabitants without the struggles and agitations which are always necessary to bring about reform. We find as early as 1848, only two years after the first settlement, that the late Daniel Saunders, with several of his worthy associates, procured a charter for the construction of water-works, under the name of the "Lawrence Aqueduct Company," the water to be brought from Haggett's Pond in Andover, but they had in some way reckoned without their host and the project fell through. *Public* water-works were far less popular in those days than they have since become, and though the subject was more or less agitated, the young town was so frequently called upon to make large expenditures in other directions, that a *public* water-supply was considered beyond its means. So in 1851 the Essex Company and the Bay State mills joined in the construction of a reservoir of 1,500,000 gallons capacity on Prospect Hill, with an elevation of 152 feet above crest of dam, for the supply of the several manufacturing corporations, each having a separate system of distribution; the Bay State Mills pumping the water from the canal. Later, six of the other leading corporations joined in the enterprise and organized under the name of the "Lawrence Reservoir Association," each doing a share of the pumping into one common main from which any surplus over the day's consumption found its way into the reservoir, and was drawn back during the night. By an arrangement between the City Council and Reservoir Association, pipes were laid from this main through some of the principal streets of the city, and hydrants established for fire protection. This state of things continued for over twenty years, the population, meantime, increasing very rapidly and buildings being placed so compactly, that in the absence of any system of sewerage, the wells and cesspools became so mixed that in some cases it was said to be difficult to tell one from the other, and the necessity for a purer supply of water appeared so urgent that the agitation during the years 1871 and 1872 became general and earnest, resulting in the passage of an enabling act by the Legislature which was approved by Governor William B. Washburn, March 8, 1872. This act provided for the appointment of commissioners, taking land, raising money, and other matters. Although the acceptance of the act by the legal voters was very bitterly opposed by many it was however approved on May 2 by a large majority, and a joint special committee on water appointed, of which James Payne, Esq., was chairman. This committee were fortunate in the choice of L. Fred Rice, of Boston, as Consulting Engineer, who, after making the necessary surveys and giving the matter due study, made a very able and exhaustive report materially shaping the course to be pursued by the Constructing Commissioners, Messrs. William Barbour, Patrick Murphy, and Morris Knowles, who were elected as such on the 8th of May in the year following, and with W. F. McConnell as engineer, and James P. Kirkwood, Esq., of Brooklyn, N. Y., as consulting engineer, began at once the construction of the present system of water-works. The Merrimack River, at a point a little less than a mile above the dam of the Essex Company, was chosen as the source, and pumping to distributing reservoir the plan adopted, and the result of the labors of these far-seeing and energetic men is one of the most complete and efficient plants in the country. The pumping-station is situated on the north bank of the river, at a point forty-seven hundred feet west from Broadway, one of the principal streets of the city. The buildings are built of face brick, with freestone trimmings, and slate roof, with the exception of the coal-shed, which, being at the level of the ground, is constructed of brick arches laid on wrought-iron girders, a layer of gravel over this, and the whole covered with concrete. This peculiar arrangement admits of the coal being hauled directly over the roof, and dumped into the coal-room through scuttles without rehandling. The buildings rest upon a solid foundation of rubble masonry, laid in hydraulic cement, which extends to a depth of twenty-two feet below the floor-line of the basement.

The engine-house is sixty-six feet square on the exterior, and fifty-six feet from floor-line to apex of roof. The boiler-house is fifty-seven feet nine inches by fifty-five feet, and forty-two feet six inches in height. The coal-room is in interior dimensions fifty-one feet nine inches by fifty-eight, and twelve feet in height, with a storage capacity of eight hundred tons of coal. The boiler-room is in the interior forty-five by fifty-one feet and six inches, with a total height from top of floor-line of thirty-eight feet. The en-

* A paper by Mr. Henry W. Rogers, Superintendent of the Lawrence, Mass., Water-Works, read at the meeting of the New England Water-Works Association, and printed in the Journal.

gine-room is in interior dimensions sixty-two feet square, and fifty-two feet in height.

The main room is lighted by ten large windows and all necessary offices and store-rooms are conveniently arranged. The buildings are heated by steam and are practically fire-proof. The chimney is located at the west end of the boiler-house, passing up through the coal-room, and is in height one hundred and eighty-three feet above floor-line. The supply for the pumps which is taken directly from the river, is introduced through a conduit extending from the pumping-station into the river, one hundred and seventy feet. A filter-gallery, three hundred feet long and eight feet in vertical and horizontal diameter, extends east from the building, along the bank of the river; the side walls are built of rubble masonry laid in cement and roofed in with an arch of brick. At the bottom are cross-braces of granite blocks eight feet long and one foot square, laid ten feet apart and filled to the surface with small stones.

The pumping-engines were built by I. P. Morris & Co., at the Port Richmond Iron-Works, Philadelphia, from the designs and under the patent of E. D. Leavitt, Jr., of Cambridge, Mass.

They are overhead beam-engines, with compound cylinders, and are both coupled to the same fly-wheel shaft by cranks set at right angles with each other.

The general appearance of the engines is massive and imposing, giving an impression of strength and solidity, with a judicious disposition of material.

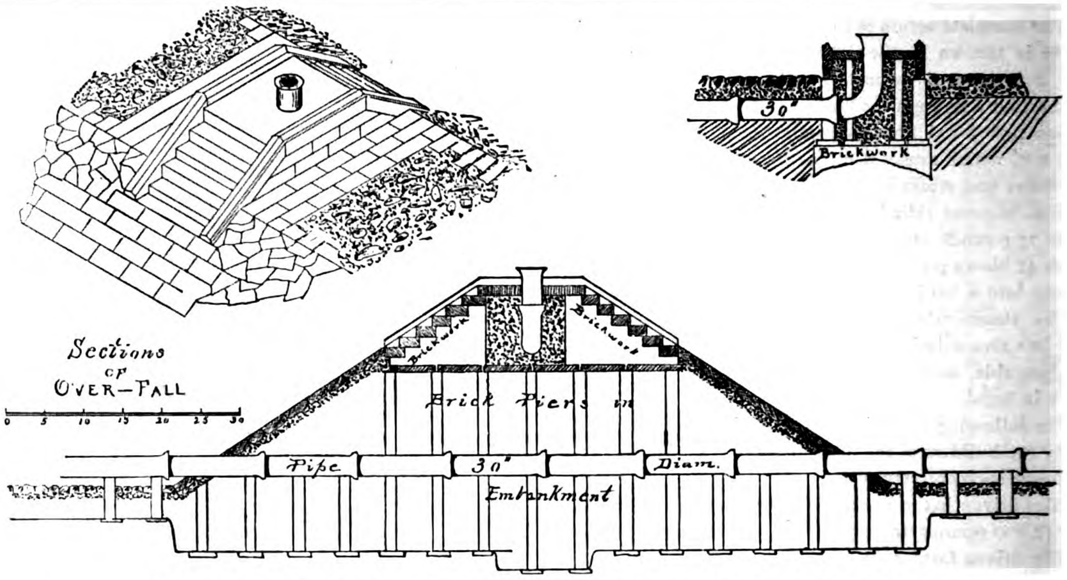
The principal dimensions are as follows:

Diameter of high-pressure cylinders	18 inches.
" low " "	38 "
" working-barrel of pumps	26⅛ "
" pump-plungers	18⅜ "
" fly-wheel	30 feet.
" air-vessels	54 inches.
" air-pumps	15 "
" main-journals	14 "
" main shaft on body	16 "
" double-beat valves, outside	15¾ "
" " " inside	12½ "
Length of stroke of steam and water-pistons	8 feet.
" of cranks between centres	4 "
" between end centres of beams	16 "
" of stroke in air-pumps	28 inches.
" of bed-plates over all	33 ft. 7⅝ in.
" of engines "	42 ft. 6⅝ in.
Width of " "	28 ft. ½ in.
" each bed-plate, extreme	9 ft. 10½ in.
Distance vertically from top of beams to bottom of pumps	55 feet.
Approximate weight of each bed-plate	30 tons.
" " " beam	13 "
" " " pump complete	38 "
" " fly-wheel	18 "
" " shaft and cranks	10 "
" " both engines complete	310 "

The capacity of each engine is two hundred thousand gallons per hour, running at a speed of sixteen revolutions per minute.

The pumps discharge into a force-main line of cast-iron pipe, thirty inches in diameter, laid in the centre of Ames Street, extending to the reservoir, and in extreme length about five thousand feet. In order that the force-main might be utilized as a supply-main, as has often been necessary when having the supply-main shut off for making connections or repairs, it was laid with a fall to the river, and to avoid very deep cutting a brick tunnel six feet high and seven feet wide, egg-shaped, with flattened bottom, was made through Emery's Hill a distance of nine hundred feet.

The reservoir is situated on Bodwell's Hill, in the western part of the city, about one and one-eighth miles from the City Hall. It is of rectangular form, seven hundred and thirty feet long, and four hundred and eleven feet wide, measured on top in the centre of the embankment, and twenty-eight feet deep, with a division embankment, forming two basins, having a total capacity of 40,000,000 gallons when filled to the high-water mark, which is twenty-five feet from the bottom. The top of the division embankment is six feet lower than the other embankments, so that when the reservoir is full to the high-water mark—that is, three feet from the top—there will be three feet of water over the division embankment, thus making it appear as one basin. The overfall is located in the centre of this embankment where the water from the force-main discharges through a bell-shaped pipe, specially designed for this purpose, upon a stone platform, from which it falls down over six granite steps ten feet wide into the basins, or, by using flash-boards, can be turned into either at will. This method breaks up the mass, and thoroughly aerates all the water pumped into the basins, thus further tending



SHOWING RELATIVE POSITION OF PUMPS, RESERVOIR AND PIPE LINES. LAWRENCE WATER WORKS.

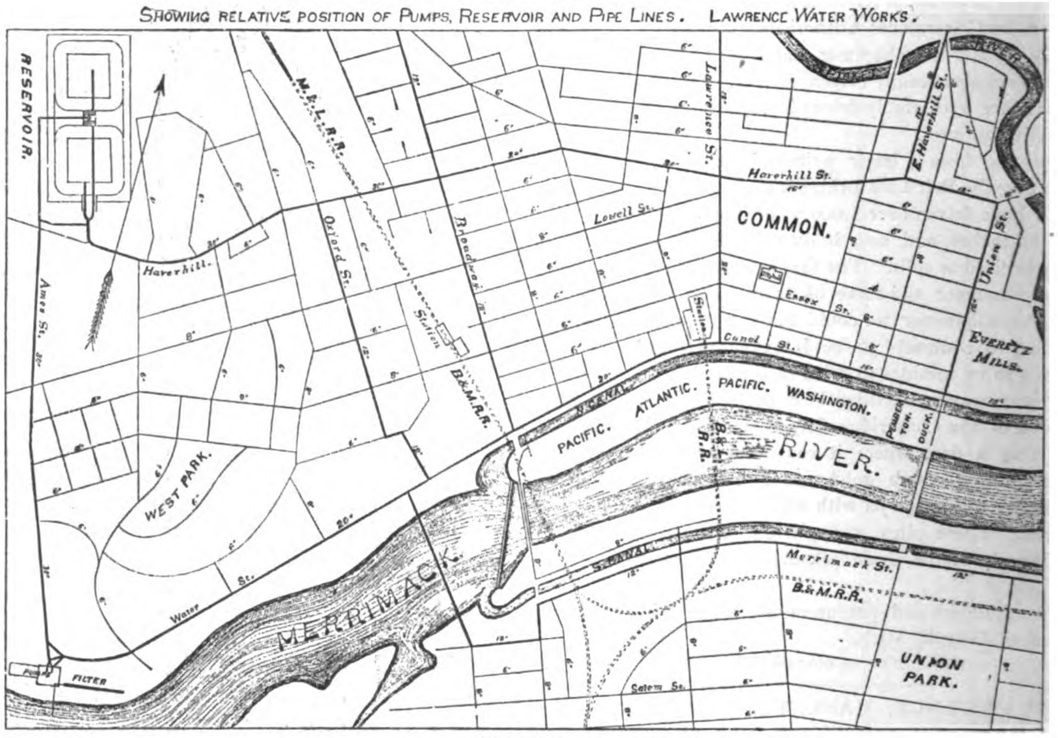
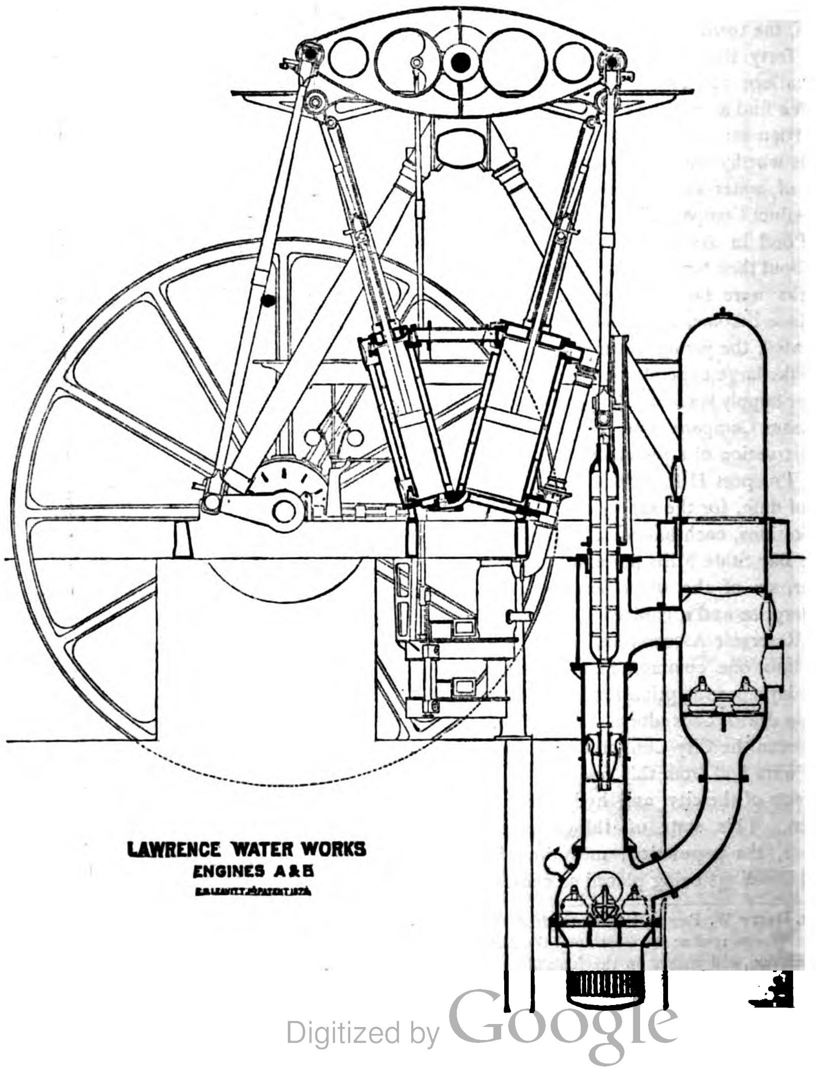


PLATE II.



LAWRENCE WATER WORKS
ENGINES A & B

to purify it and increase its desirability for domestic and general purposes. The top of the overfall is at the same height as the main banks.

In the middle of the south bank is the gate-house, with its massive granite foundation starting eleven feet below the bottom of the reservoir. In this building are situated double copper wire-cloth screens of ⅜-inch mesh, also the gates controlling the delivery and separating one basin from the other.

A 30-inch supply-main extends from the reservoir down to the interior of the city. The distributing-mains, of which there are fifty-two miles in use, are all of coated cast iron, ranging from six to thirty inches inside diameter, supplying four hundred and ninety Lowry hydrants, and controlled by six hundred and forty stop-gates.

Rubber-coated and galvanized wrought iron has been extensively used as service-pipe, but lead is now taking its place. There are four thousand three hundred services, measuring twenty-seven miles, supplying about eleven thousand takers, including thirty-five thousand persons in dwellings and boarding-houses.

The income from water-rates and metered water for the year 1886 amounts to $77,793.17. Bonded debt $1,300,000.

PAVEMENTS AND STREET RAILROADS.

No. V.

(Continued from page 293.)

As a valuable contribution to this subject, as clearly pointing out the right method of coming to a decision in the adoption of a system of street-paving, we give below a careful abstract of a report recently made to the Common Council of Topeka by a committee appointed for the purpose. This committee visited a number of cities, and conferred with engineers, property owners, and tenants; they also obtained a large number of reports and standard works upon the subject.

The first conclusion they arrived at was, not to consider pavements or materials of an experimental character, as it requires a number of years to come to a correct decision as to the success or failure of an experiment of this character.

The first pavement considered was *brick*. As laid at several places, the graded street is covered with several inches of sand, on which is placed two layers of brick, the first on the flat, the second on edge, making about six inches thickness of brick. This they report against, principally on the ground of lack of uniformity in the material. They found no place where the pavement was satisfactory except on streets having very light traffic. Bloomington, Ill., favored it where not more than 100 teams per day passed over it. Decatur, Ill., and Cincinnati reported against.

MACADAM

was next considered. A brief summary is given of the experience had by a number of cities.

The authorities of Toronto say: "Our experience is enough to utterly condemn it. We have spent more than $10,000,000 in macadamizing streets, which became seas of mud after a few hours' rain. It will actually cost the residents on Yonge Street thousands of dollars to get rid of the macadam and put themselves in the favorable position of having only a dirt road to be dealt with."

In Fall River the stone used is harder, but "macadam roads will not stand the wear due to heavy teaming."

In Sandusky, O., limestone is used for the macadam, and "it wears away so rapidly that it requires almost constant attention" to keep it in order.

The Board of Public Works of Washington consider it as only suitable for country roads.

Cincinnati reports "the chief thing permanent about the limestone macadam of that city has been the permanent *expenditure* for repairs."

St. Louis recommends the abandonment of limestone macadam on account of rapid wear, mud, and dust.

Mr. Hill, City Engineer of New Haven, reports that though cheapest in first cost, even the best macadam is more expensive to maintain.

In Kansas City, St. Joseph, Omaha, Atchison, and Leavenworth it is being taken up, or is only used on streets where pleasure driving is the rule.

The committee therefore decide they "would prefer the present dirt roads."

WOOD PAVEMENTS

of the old varieties are conceded to have proved failures. The white cedar blocks (more properly cypress) sawed from small trees are being laid in Chicago, Kansas City, Omaha, upon concrete foundations and also on boards. The life of the latter they consider to be about three years. That on concrete would cost in Topeka about the same as granite block, or sheet asphalt, and if the cypress blocks were creosoted, as are the pine blocks now used in England and France, the cost would be still greater.

ASPHALT BLOCKS,

in size 4x5x12 inches, composed of genuine asphalt and broken stone, compacted by hydraulic pressure, have in some places failed rapidly. In other places they are approved for light traffic.

The patentees do not consider them suited for anything else, and also consider it essential that they be made at or near the place used.

They are therefore reported against.

STONE BLOCKS.

For this use, Medina and Colorado sandstone, they say, take first rank as to durability. Omaha and Kansas City are using Sioux Falls and Missouri granite. While the granite may be somewhat more lasting, the sandstone is very durable, is less noisy, and has the advantage of not becoming polished or glossy in use. Hard Argentine limestone was tried in Kansas City on a concrete foundation, but, being set on edge, it wore unevenly, and in a year or two was shivered and split by the frost, and has had to be replaced by granite and limestone. This is the universal experience of all cities using limestone blocks.

Captain Greene, of Washington, states that granite pavements there have given satisfaction, except on the score of noise. This has led to its restriction to streets having exceptionally heavy traffic, and a desire for the substitution of asphalt even on these.

ASPHALT AND COAL-TAR.

The confusion of mind respecting these is first mentioned, and then the defects of the latter are pointed out. These consist in the fact, that if the boiling is continued long enough to remove the volatile matters, the material becomes brittle and soon crumbles after being laid; while if the volatile portions are *not* removed, the pavement is too soft in hot weather. "Coal-tar softens at 115° Fah., and is very brittle at the freezing point; while true bitumen is tough at 20° Fah., and will not soften at 170° Fah." General Gillmore and Captain Greene reported against the use of coal-tar for pavement, on the ground of the gradual oxidation of the cementing substance, and the disintegration that is sure to follow. Other authorities say that when this occurs, the only remedy is to patch them, and this is never satisfactory.

Other cities give testimony much like the above. General M. C. Meigs writes to a similar committee from Philadelphia: "The average annual cost of coal-tar pavements in Washington is about six times as much as that of good asphalt pavements."

The Engineer Commissioner of Washington, in 1885, reports asphalt as the standard pavement for seven years past.

Buffalo laid over sixteen miles between 1882 and 1886, and is laying many miles more, and it has given the highest satisfaction.

At St. Joseph, Mo., they are now substituting it for the limestone macadam, which has failed. The specification there used is the same as that of Washington. After grading the street, a layer of concrete 6 inches thick is laid down, and when fully set a "cushion coat" of asphalt-mastic one-half inch thick is spread. This is followed by another layer 2½ inches thick, containing 60 to 70 per cent. of fine sand, with a small percentage of limestone dust.

Streets with grades of 4 to 5 per cent. have been laid, but it is not considered good practice on account of slipping of horses in wet or icy weather.

For this reason in Kansas City, where the grades are mostly high, the standard pavements are stone blocks of granite or Colorado sandstone and cedar blocks on a concrete base.

For the same reason in Cincinnati the Board of Public Works recommend granite blocks on all streets of over 2½ per cent. grade, and asphalt-mastic on streets of less grade.

In Omaha, where the climate in winter is especially severe, this pavement has borne the test for four years thoroughly well. There are now over seven miles of it in use there, on business and semi-business streets, and it is giving entire satisfaction.

FIRST COST AND MAINTENANCE.

Cedar-block pavement costs in Milwaukee, laid on boards, 85 cents per square yard. In St. Paul, creosoted and laid after the English method, $3.40. In London, England, the *treating* of the blocks by chemicals costs $2.50 to $4.83 per yard, and cost of maintenance each year 20 per cent. of cost. In Leavenworth and Kansas City, on six inches of concrete, the first cost is $2.30 to $2.63, with an average life of the blocks of four to six years, when the blocks can be renewed on the old base.

In Omaha, Colorado sandstone pavement costs $2.61 to $2.67 for blocks eight inches deep on eight inches of sand, and Sioux Falls granite $2.53 on sand and $3.09 on broken stone and sand foundation. Asphalt on a 6-inch concrete base cost $2.98, with a money guarantee to keep it in perfect order for five years.

In Washington granite cost, in 1884, $2.50 to $2.65.

In St. Joseph, the cost for asphalt, with the five years' guarantee, was $2.63 in 1886.

In Topeka the estimate is $3, which would include grading of about nine inches of the street.

The committee state truly that a poor pavement well laid and *well maintained* is better than a good one with poor maintenance. Had they visited New York City they might have stated this with even more emphasis.

As a final conclusion they recommend "standard sheet asphalt on a concrete base" for the street then under consideration, except where the grades were too heavy, and that where this is the case, granite or sandstone block pavement be laid; all to be under a five-year guarantee. They also recommend that any plumber desiring to tear up improved streets shall file a bond of $1,000 for the faithful replacing of the street and pavement, and also keep at all times a deposit with the city of $25, cash, to be used in repairs where needed.

In continuation of this important subject we would quote next from an article in the Cleveland *Leader*, giving some important information respecting

FIRE-BRICK PAVEMENTS.

A committee, after visiting Steubenville and Wheeling to examine the pavements there, reported that it is smooth, durable, cheap, and free from noise. On the entire length of one street examined in Wheeling they did not find a broken or crushed brick. Part of the paving had been down two years and another part three years, and one was apparently as perfect as the other. The bricks are made from a softer clay, and are burned harder than ordinary brick. A pressure of eighty tons was not sufficient to crush one.

Mr. J. F. Holloway, Civil Engineer, read a paper strongly indorsing the use of this material. A pavement in Allegheny City examined by him was very smooth, and he could not hear the rumble of carriage-wheels until they were within fifty feet of him. The street was easily cleaned, and made a handsome appearance. The pavement can be laid for from $1.20 to $1.60 per square yard. Not one of a number of 2-inch cubes failed under sixteen tons pressure; or, in other words, they bore safely a strain of 8,000 pounds per square inch, which is considerably more than the crushing strength of the best pressed brick.

The bricks are 9"x5"x2" or 3" and are made in West Virginia. The upper layer is laid on edge with the spaces filled with pitch or tar and covered with sand.

METHOD OF ASCERTAINING THE THICKNESS OF BOILER-PLATES.

The *Illustrate Zeitung für Blechindustrie* calls attention to a method discovered by M. Lebateur for defining the thickness of boiler plates or other objects where it is difficult to arrive at this information without actual measurement. He spreads a layer of tallow $\frac{1}{10}$ of an inch in thickness upon the metal, and a similar layer upon a piece of known thickness. Both are then subjected for a certain time to the action of a small heated instrument, resembling that used by medical men in cauterization. The tallow melts, and a thick metal is a better conductor of heat than thin metal; the tallow melted upon the thicker plate occupies a greater space than that on the thinner sheet. From the appearance of the two plates the relative thickness is then calculated.

One more victim of a burning car is Alfred A. Perrine, Mail Agent on the Pemberton and Haightstown Railroad, who was burned to a crisp in his derailed mail-car on the 8th inst., near Sharon, Pa. Seven others were badly injured by the same accident. The car rolled down the embankment and the mail agent was burned up within it before help could be given him. The conductor of the same train barely escaped with his life by being removed in an unconcious state from under the car-stove.

SEWAGE DISPOSAL AT BROCKTON, MASS.

THE first attempt in this country, on a large scale, to dispose of sewage by irrigation is likely to be made by the thriving city of Brockton, which is situated in Plymouth County, Mass., and is about twenty miles south from Boston, on the line of the Old Colony Railroad. Early in 1885, Samuel M. Gray, M. Am. Soc. C. E., City Engineer of Providence, R. I., visited the city under the auspices of the Commercial Club, and, later in the season, Colonel George E. Waring, Jr., C. E., was invited there by the Committee on Sewerage and Drainage, and both of these gentlemen recommended, after examination, the separate system. Later in the season Mr. Gray, upon another visit, confirmed the opinion expressed by Colonel Waring, that disposal by precipitation is not advisable for the city of Brockton. By this time the city was so far committed to some plan of disposal upon land as to purchase, in anticipation of future needs, a mill privilege upon the Salisbury Plain River, known as Ward's Dam, and the right of flowage at the Matfield Meadows.

In December, 1885, Rudolph Hering, C. E., made an examination of the case, and, in a valuable report to the Committee on Sewerage and Drainage, he recommended disposal, south of the city, upon the Matfield Meadows, at at a first cost for $1\frac{8}{10}$ million gallons per day of $124,190. This estimate includes the partial preparation of 120 acres of rather wet heavy soil; the lowering about six feet and straightening of 6,500 lineal feet of the river channel; the complete preparation by underdraining, grading, and furrowing of 60 acres of the before-mentioned 120 acres; the construction of a new dam, the outfall sewer, and subsiding tanks.

Mr. Hering made an estimate, also, for disposal upon the Muster Field, a tract of land lying about three miles west of the city, and in its character much superior to the Matfield Meadows for the disposal of sewage. Sewage can be put upon the Muster Field only by pumping, and this, together with the length of force-main required, brought Mr. Hering's estimate of cost for this locality to $178,756.

In November, 1886, Phineas Ball, C. E., of Worcester, made an elaborate report to the committee, in which he took decided ground against the Matfield Meadows and in favor of the Muster Field. In Mr. Ball's opinion, grading, furrowing, and underdraining would be demanded to a very limited extent at the Muster Field, and to so large an extent at the Matfield Meadows as to make the former location to be preferred in spite of the cost of pumping and a long forcing main. By Mr. Ball's plans the Matfield scheme would cost $73,282, and the Muster Field $67,133, with an annual outlay of $2,150 for pumping in each case. By Mr. Hering's plan no pumping is required for Matfield Meadows. Supported by the advice of the engineers above-named, the city of Brockton has asked the Massachusetts Legislature for a bill allowing them to take land and proceed with the work under Mr. Ball's plan and direction. The Muster Field lies almost wholly in the adjoining town of Easton, and the only serious opposition to the Brockton bill has come from citizens of that town. Some of the Easton remonstrants have made a desperate effort by newspaper rhetoric to frighten the authorities of Taunton, some thirty miles below in the river valley, into opposing the scheme, but thus far without success.

The City Solicitor of Taunton did request the Legislative Committee to insert a section in the bill which should insure proper management of the irrigation fields wherever locateds, as was quite proper.

The only opposition which Brockton has encountered has come from citizens of Easton, who are abutters upon the proposed irrigation field, and who fear that their health and happiness are to be endangered. Brockton met these objections by the testimony of Eliot C. Clarke, C. E., Charles H. Swan, C. E., and Simpson C. Heald, C. E., all of whom could testify, from personal observations of the sewage-farms of England, France, and Germany, that the Easton abutters had no cause for alarm—provided, always, that the irrigation fields are properly managed.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE fifteenth annual meeting will be held at Washington about the middle of May. Papers for the meeting should be sent to the Secretary, Mr. F. R. Hutton, 280 Broadway, New York City, before March 25, the ballot lists for new members have been issued.

ST. LOUIS ENGINEERS' CLUB.

THE club met March 22, President Potter in the chair. Messrs. Alexander E. Abend, Charles F. Muller, Max G. Schinke, and Lewis Stockett were elected members of the club. The application of G. W. Dudley for membership endorsed by J. B. Johnson and H. B. Gale, was announced and referred to the Executive Committee. Mr. Robert Moore read a paper on the "Present Aspects of the Problem of Inter-Oceanic Ship Transfer." A history of the various schemes which had been made public was given, as well as the results reached and the difficulties yet to be met. At present the question had narrowed down to three prominent routes, each of which has its supporters. The De Lesseps Panama Canal was discussed at length, the present condition of the work noted, its cost thus far, and the amount necessary to finish it shown. This, as well as the grave engineering difficulties to be solved, and on which the success of the work hinged, led the speaker to believe its completion impossible and its early collapse probable. The second scheme, known as the Tehuantepec route, was, for topographical reasons, not available for a canal, but has been chosen by Capt. James B. Eads for his ship railway. This plan was also discussed at length, and its advantages and disadvantages considered. The great first cost, the cost of operating, and the serious and as yet unsolved engineering difficulties to be met, seemed to throw the preponderance of evidence against the enterprise. The third scheme was that known as the Lake Nicaragua Canal, which so far has not been as prominently mentioned as the others. While its first cost is undoubtedly great, it is not so large as either of the others, and its operating expenses would be much less. The work was of great magnitude, but yet of a character which had already in many instances been successfully handled, and in the whole route nothing new or untried would be met. On the whole, the speaker believed the Nicaraguan scheme the one which best deserved the recognition and support of the American people. The paper was discussed by Messrs. Potter, Seddon, McMath, H. C. Moore, and Ockerson.

CONSTITUTION FOR THE PROPOSED CANADIAN SOCIETY OF CIVIL ENGINEERS.

UNDER date of December 9th last, the Provisional Committee for the formation of a society under the title above have adopted a form of constitution.

The committee is composed of Messrs. Colonel Gzowski, Kivas Tully, W. T. Jennings, T. C. Keefer, Henry T. Perley, William P. Sanderson, Robert Surtees, Professor Bovey, John Kennedy, P. A. Peterson, and Percival W. St. George.

The novel features in the constitution are the adoption of five classes of members—viz.: Honorary members, members, associate members, associates, and students—of which members must have followed some branch of the profession for ten years, and associate members for five years. Associates and students correspond to associates and juniors in the American Society. The fees are fixed at a very low amount—$8 for resident and $6 for non-resident members only, etc.

They grapple with the problem of local clubs or sections in the following manner:

A local branch may be established under the authority of the Council, at the request of not less than ten members, in any place not less than one hundred miles from the headquarters of the society, or from any existing branch. But membership in such branch does not release the members from fees or other obligations to the society. All members of local branches must be elected by the whole society in the usual way, and all papers are to be the property of the society and published only by it or under its express permission.

All papers are to be examined by the Council, and, if deemed of sufficient interest, copies are to be sent to every branch of the society for reading and discussion, at the same time as at the headquarters, or as soon as practicable thereafter.

The only officers of a branch will be chairman and secretary-treasurer, but the society will have a president, two vice-presidents, treasurer, secretary, and fifteen councillors, of whom five are to form a quorum.

There are proper safeguards as to the care and expenditure of money, provision for expulsion of unworthy members, formation of committees, etc., and the whole seems to have been prepared with great care.

THE WESTERN ASSOCIATION OF ARCHITECTS.

THE Board of Directors and the Secretary, Mr. James F. Alexander, of Lafayette, Ind., are already at work to secure an interesting and successful convention for the next annual gathering. Circular-letters have been addressed to the committees on "Drawings for Exhibition," on "Competitions," and on "Uniform Contracts and Specifications," asking from them diligent co-operation with their chairman, and the presentation of all pertinent matters in time to be noticed in the reports, which will be filed with the Board of Directors not later than October 15.

It is intended to secure a large exhibition of water-colors and pen and pencil drawings and photographs.

The constitution and by-laws, bound in neat form, has been issued.

NEW ENGLAND WATER-WORKS ASSOCIATION.

THE March meeting of this society was held at Young's Hotel in Boston on Wednesday, March 9. About fifty members and guests had assembled and were engaged in animated conversation when, at one o'clock, dinner was announced. After cigars had been lighted, President Rogers introduced Albert F. Noyes, Mem. Am. Soc. C. E., City Engineer of Newton, Mass., who read a carefully prepared paper upon "Driven Wells as a Source of Water-Supply."

Mr. Noyes began with a historical sketch in which he named when, where, and by whom the use of driven wells was begun in this country. Colonel Green and Calvin Horton are closely identified with this method of obtaining water. The paper described in considerable detail the tools and methods employed, and distinguished between driving and boring.

The great difference in the quantity of water which is stored in the voids of different soils was noted and figures were quoted. The writer insisted that the amount of water to be obtained from any system of pipe-wells can only be known with any approach to certainty after thorough experiments extending over a considerable period of time. The question as to the comparative amounts of water to be obtained from driven and open wells was briefly discussed and the conclusion reached that no general rule could be formulated.

By the courtesy of Chief Engineer Van Buren, Mr. Noyes was able to give full details of the Andrews driven wells in use at Brooklyn, N. Y., which may be quoted as a successful example of this method of obtaining water.

Cohassett, Hyde Park, and Westboro, Mass., were mentioned as towns in which driven wells have been successfully used.

The paper was discussed by M. M. Tidd, Mem. Am. Soc. C. E., of Boston, who was in charge of the work at Hyde Park and who confessed to a lack of confidence in driven wells in general, but admitted that in many cases this seemed to be the only feasible method.

Mr. Tidd spoke of Cohassett, Mass., as an instance of driven wells in an unusually favorable location, and said that the evident water-shed is an important factor in selecting a location.

Mr. J. A. Tilden, of Boston, who, under the direction of the late J. C. Hoadley, C. E., conducted a series of experiments in the town of Melrose, to determine if the slope of the ground-water toward a driven well were any greater than toward a dug or open well, gave some accout of those experiments.

This careful and exhaustive set of experiments seemed to show that no more water can be obtained by any patented process than can be had by any simple method of driving.

President Rogers spoke of the experience of certain parties in Lawrence, Mass., who have endeavored to obtain water for boiler use from driven wells, and who have ruined their boilers thereby, while C. F. Allen, Secretary of the Hyde Park Water Company, gave evidence of a contrary character.

THE annual report of the Commissioners of the Massachusetts State Topographical Survey has been sent to the Legislature.

A BANQUET will be given the National Association of Builders, which meets in Chicago March 29, 30, and 31, on the closing evening of the convention.

THE State Sanitary Convention will be held at Warren, O., March 30 and 31, at which several interesting topics will be discussed.

DOMESTIC PLUMBING & HEATING LIGHTING & VENTILATION ENGINEERING

REVISED RULES FOR STEAM-BOILER INSPECTION.

AT the regular annual meeting of the Board of Supervising Inspectors of Steam Vessels, held in rooms 60 and 62, Corcoran Building, Washington, D. C., January and February, 1887, amendments were made to Rule I., Section 3; Rule V., Section 5; Rule IX., Section 14 (new), which were approved by the Secretary of the Treasury February 8, and have now the force of law.

The boilers presented for approval by the Huber Manufacturing Co., Marion, O.; J. W. Walters, New York (presented by F. C. Brecht, Navy Department, Washington, D. C.) and Francis O. Burrows, Cleveland, O., were decided by the board not to require its approval. They being constructed of riveted iron and steel plates, their use is permissible without such approval, subject to the discretion of the local inspectors only as to amount of steam, *et cetera.*

In reference to several "feed-water heaters" presented for approval, the Board decided that such devices did not require its approval; therefore no action was deemed necessary—in substance, leaving it to the discretion of local inspectors to decide in the case of each boiler inspected to determine that "the arrangement for delivering the feed-water is such that the boilers cannot be injured thereby," and that the temperature is in conformity to the provisions of Section 12, Rule II.

Following is the full text of the various sections of rules as amended, the parts that have been stricken out enclosed in brackets [thus], while the amendments, as approved, are printed in *italics*:

RULE I., Sec. 3. To ascertain the tensile strength of plates, a piece shall be taken from each sheet to be tested, the area of which shall equal one-quarter of one square inch on all plate $\frac{5}{16}$ inch thick and under; and all plate [over] $\frac{5}{16}$ inch thick *and under $\frac{3}{4}$ inch thick* the area shall equal *three-quarters* [the square] of its thickness; *and all plate over $\frac{3}{4}$ inch thick, the area shall equal one-half of its thickness;* and the force at which the piece can be parted in the direction of the fibre or grain, represented in pounds avoirdupois—the former multiplied by four, the latter in proportion to the ratio of its area—shall be deemed the tensile strength per square inch of the plate from which the sample was taken; and should the tensile strength ascertained by the test equal that marked on the plates from which the test-pieces were taken the plates must be allowed to be used in the construction of marine boilers: *Provided always,* That the plates possess homogeneousness, toughness, and ability to withstand the effect of repeated heating and cooling; but should these tests prove the plates to be overstamped, the lots from which the test-plates were taken must be rejected as failing to have the strength stamped thereon. But nothing herein shall be so construed as to prevent the manufacturers from restamping such plates at the lowest tensile strength indicated by the samples, provided such restamping is done previous to the use of the plates in the manufacture of marine boilers.

RULE V., Sec. 5. No person shall receive an original license as engineer, or assistant engineer, except for special license on small pleasure-steamers, who has not served at least three years in the engineer's department of a steam-vessel: *Provided,* That any person who has served for a period of three years as a locomotive or a stationary engineer, or as a regular machinist in a steam-engine works at least three years, may be licensed to serve as engineer on steam-vessels after having had not less than one year's experience in the engine department of a steam-vessel of twenty tons or upward (which fact must be verified by the certificate in writing of the licensed engineer or master under whom the applicant has served), and no person shall receive license as above, except for special license, who is not able to determine the weight necessary to be placed on the lever of a safety-valve (the diameter of valve, length of lever, and fulcrum being known) to withstand any given pressure of steam in a boiler. Or who is not able to figure and determine the strain brought on the braces of a boiler with a given pressure of steam, the position and distance apart of braces being known, and no engineer or assistant engineer now holding a license shall have the grade of the same raised without possessing the above qualifications.

RULE IX., Sec. 14. (New.) When it is known, or comes to the knowledge of the local inspectors, that any steam-vessel is or has been carrying an excess of steam beyond that which is allowed by her certificate of inspection, it is recommended that the local inspectors in whose district said steamer is being navigated, in addition to reporting the fact to the U. S. District Attorney for prosecution under Section 4,437, Revised Statutes, shall require the owner or owners of said steamer to place on the boiler of said steamer a lock-up safety-valve that will prevent the carrying of an excess of steam, and shall be under the control of said local inspectors.

On the placing of a lock-up safety-valve upon any boiler, it shall be the duty of the engineer in charge of same to blow, or cause the said valve to blow off steam at least once in each watch of six hours, or less, to determine whether the valve is in working order, and it shall be his duty to report to the local inspectors any failure of such valve to operate.

In case no such report is made, and a safety-valve is found that has been tampered with, or out of order, the license of the engineer having such boiler in charge shall be revoked.

The following devices were approved by the Board, which have also received the approval of the Secretary of the Treasury, as required by Section 4,491, Revised Statutes:

O. R. Ingersoll's Life-Raft, composed of two cylinders made of cane, and filled with block-cork. To be rated according to Section 15, Rule III.

O. R. Ingersoll's Life-Boat.

F. L. Norton's Life-Boat. (Boats to be built of yellow metal.)

The Edward Maynard Life-Preserver, presented by John T. Smith, of New York City.

The Le Duc Life-Preserver, presented by Joseph K. McCammon, of Washington, D. C., when constructed of best quality block-cork.

The Farnie Boiler, presented by Messrs. Farnie & Geer, of Syracuse, N. Y. (when constructed in all its parts of wrought iron or steel, and such pressure to be allowed on such boiler as the bracing will entitle the same to carry).

C. H. Carwell, of Newport, R. I., Coil Boiler (when constructed in all its parts of wrought iron or steel.)

The Belleville Boiler, presented by Myers Coryell, of New York (when constructed in all its parts of wrought iron or steel.)

The Hartley Boiler, presented by the Pioneer Iron-Works, Brooklyn, N. Y. (when constructed in all its parts of wrought iron or steel).

A PROPOSED BUILDING LAW FOR CINCINNATI.

A BILL to regulate the construction and plumbing of buildings and to provide for the appointment of a building inspector is now before the Ohio Legislature. It is intended to apply to cities of the first class, and as understood would, therefore, only include Cincinnati. Our attention has been called to that and our opinion asked concerning a number of its provisions.

At this time we are only to notice the clauses that refer to the plumbing and drainage of buildings, which are as follows.

This bill has been prepared through the joint efforts of committees from the Builders' Exchange and the Cincinnati Chapter of Ohio State Association of Architects, and Master Plumbers' Association. Other provisions relating to the construction of buildings, etc., will be noticed at another time.

SECTION 49. No person or persons shall carry on the business of plumbing, or engage in conducting plumbing or house drainage until he or they shall obtain a license as such plumber from the Board of Public Affairs, and no person shall receive such license who shall not have an established place of business within the limits of said city of the first class, and who shall not furnish the Board of Public Affairs satisfactory evidence of his responsibility and skill to apply his trade in accordance with the rules and regulations of the Board of Public Affairs, the Board of Water Commissioners, the Board of Health, and the Ordinances of said city of the first class, and it shall be the further duty of every person or persons making an application for a license to carry on the business of plumbing, to accompany his or their application with a bond signed by two or more sureties, to be approved by the Board of Public Affairs, in the sum of five hundred dollars ($500), conditioned that he or they will indemnify and save harmless said city of the first class from all accident and damage caused by negligence either in the execution or protection of his work, or for any unfaithfulness or inadequate work done under and by virtue of his license; and that said license, as such, will also conform to all the conditions and requirements of the city for his or their government, or in default thereof, will submit to such penalties as are or may be prescribed by the Board of Public Affairs, the Board of Water Commissioners, the Board of Health, or the Ordinances of said city of the first class. The inspector of buildings shall have authority and power whenever, in his opinion, any plumber, in doing any plumbing or house-drainage, violates any rule or regulation of the Board of Public Affairs, the Board of Health, the Board of Water Commissioners, or the Ordinances of said city of the first class, to suspend said license; and it shall be the duty of the officer making such order of suspension to report the same to the Board of Public Affairs, and if the said Board shall be of the opinion that the charges are well founded, they may revoke said license.

SEC. 50. Every plumber, before doing any work in a building, shall, except in the case of repair, obtain a certificate from the City Engineer that the drain connecting the premises with the sewer has been accepted, and shall file in the office of the Inspector of Buildings, upon blanks to be provided for that purpose, notice of the work to be performed. It shall be the duty of the owner or other duly authorized person to furnish a plan which shall show the whole course of said pipe from its connection with the house-drain to its termination above the roof of the house, and all branches, traps and fixtures to be connected therewith, which plan must be approved by the Inspector of Buildings before any portion of the work shall be executed.

SEC. 51. Every building shall be separately connected with the public sewer, when such sewer is provided, and, if such sewer is not provided, all water-closets are to drain into a cemented cesspool, built of hard brick or stone, of a capacity to be approved by the said inspector.

SEC. 52. Drain and soil pipes through which water and sewage are conducted shall be of iron, when within a building; they shall be sound, free from holes and other defects, of a uniform thickness of not less than one-fourth of an inch. They shall be securely ironed to walls or laid in trenches of uniform grade, or suspended to floor timbers by strong iron hangers, as the said inspector may direct. They shall be supplied with a suitable trap, placed, with an accessible clean-out, either outside or inside the foundation wall of the building; they shall have a fall of not less than one-eighth of an inch per foot toward the drain or sewer, and soil-pipes shall be carried out through the roof, open and undiminished in size, to such a height as may be directed by the inspector; but no soil-pipe shall be carried to a height less than two feet above the roof; changes in directions shall be made with curved pipes, and connections with horizonal pipes shall be made with Y-branches; all lines of soil-pipes, and the fittings on it, over fifty feet in length, to be the standard extra heavy pipe.

SEC. 53. Rain-water leaders, when connected with sewer or drain-pipes, shall be suitably trapped; each house-drain shall be provided with a fresh-air inlet on the house-side of the trap, extending to the external air, where inspector directs, of not less than the area of the drain.

SEC. 54. Sewer, soil-pipe, or waste-pipe ventilators shall be constructed of iron same as soil-pipe, and smoke-flues shall not be used as such ventilators.

SEC. 55. Iron pipes, before being put in place, shall be inspected by the said inspector, and coated inside and outside with coal-tar or pitch, applied hot, or other suitable material; joints shall be run with molten lead, and thoroughly calked and made tight; connection of lead pipes with iron pipes shall be made with brass ferrules, properly soldered and calked to the iron; all standing soil-pipes extending through one or more stories in height, shall be subjected to the water-pressure test.

SEC. 56. Every sink, basin, bath-tub, water-closet, slop-hopper, and each set of trays, and every fixture having a water-pipe, shall be furnished with a trap, which shall be placed as near as practicable to the fixture that it serves; traps shall be protected from syphonage or air-pressure by special air-pipes of a size not less than the waste-pipe; but air-pipes from water-closet traps shall be of not less than 2-inch bore for thirty feet or less, and of not less than 3-inch bore for more than thirty feet; air-pipes shall be run as direct as practicable, and carried through the roof.

SEC. 57. Drip or overflow pipes from safes under water-closets, and other fixtures, or from tanks or cisterns, shall be run to some place in open sight, and in no case shall any such pipe be connected directly with a drain, waste-pipe or soil-pipe.

SEC. 58. Water-pipes from refrigerator or other receptacles in which provisions are stored shall not be connected with a drain, soil-pipe or waste-pipe.

SEC. 59. Every water-closet or line of water-closets on the same floor shall be supplied with water from a tank or cistern, and the flushing-pipe shall not be less than one and one-quarter inches ($1\frac{1}{4}$) in diameter.

SEC. 60. Pipes and other fixtures shall not be covered from view or concealed until after the work has been examined by said inspector, and he shall be notified by the plumber when the work is sufficiently advanced for inspection.

SEC. 61. Plumbing work shall not be used unless the same has first been tested by the inspector, with the peppermint, ether, or water-test, and by him found satisfactory.

SEC. 62. No steam-exhaust shall be connected directly with any soil or waste pipe, or drain which communicates with a public sewer.

SEC. 63. A grease-trap shall be constructed under the sink of every hotel, eating-house, restaurant, or other public cooking establishment.

SEC. 70. The floors of all rooms when containing stationary boilers shall be made of incombustible materials, five feet on all sides, and at least eight feet in front of any boiler.

SEC. 72. Steam-pipes shall be kept at least two inches from all wood-work, otherwise they shall be protected by a soapstone, or earthen ring or tube, or a double-tube of galvanized iron, or rest on iron supports.

Besides these provisions, the bill provides for the appointment of two deputies to the Building Inspector, one of whom shall be a plumber.

[We have no suggestion to make other than in Section 51. No mention is made of ventilation of cesspool. An unventilated cesspool is dangerous.

If the citizens of Cincinnati are fortunate enough to have their houses plumbed and drained in accordance with these regulations, they should be congratulated.—ED.]

FIRE FROM STEAM-PIPES.

OUR Milwaukee correspondent writes: "Waste paper ignited from the heat of a steam-pipe and set fire to the floor of the Riverside Printing House on Grand Avenue, February 12, but was discovered in time to prevent a serious conflagration. A great many people think that steam-pipes

are safe, from the fact that steam is made from water and the pipes cannot set paper on fire."

[This question of the ignition of wood, wood pulp, or paper from steam-pipes often comes up, and evidence like the above is often cited to prove that fire actually takes place under ordinary circumstances in wood or shavings. We doubt this as a scientific fact, and until it can be proven there were no matches in the paper or anything that would produce spontaneous combustion there is nothing to demonstrate it, as it is impossible to produce the result experimentally.

It is well, however, to guard against the possibility of gniting any easily-burned materials contiguous to steam-pipes, as superheating sometimes takes place, and in any event the temperature of steam will ignite a match-head.

It is reprehensible to let a pile of paper or paper cuttings lie on steam-pipes, as in any case the paper is dried ready for ignition when the accidental condition arrives in the form of a piece of greasy waste, a ball of greasy paper from a press, a match-head or match from the pocket of the workman, or an electric spark. Fine kindling of any kind should not be kept around offices, whether there is steam or not, as it is hard to tell what may set it on fire —ED.]

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. VIII.

(Continued from page 349.)

BOILERS.

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

23. What is likely to be the greatest heat of the water in a 40-gallon boiler in an average plumbed 3-story house with the hot service-pipe returned to the boiler to keep a circulation through the pipe?

Two hundred and twelve degrees, or a few degrees higher, according to the pressure, as the heat of steam increases with the pressure.

24. Does this circulating-pipe lower the temperature of the boiler?

Yes; because of the cooling of the water owing to radiation.

25. What is the heat of steam?

Two hundred and twelve degrees at atmospheric pressure; it increases with pressure when confined.

26. What is superheated steam?

Steam subjected to extra heat, as when pipes are passed through fire.

27. Does this change its nature?

It renders it hotter and more explosive.

28. Is there any possibility of steam in the boiler of a dwelling-house becoming superheated?

None whatever.

29. Do boilers get dirty, and why?

The sediment of water separates from it and adheres to sides and bottom of boiler.

30. Does the drain-cock at the bottom cleanse them?

To a considerable extent.

31. What plan can be adopted to do so?

Taking down boiler and washing it out with a strong jet of water through a flexible tube and nozzle.

32. How does this act?

The whole interior surface can be reached and thoroughly cleansed.

33. Can water-tanks in any part of the house be connected with water-back instead of having a boiler?

Yes; it was the method employed years ago to store the supply of hot water in a tank in upper story of house, and was heated by a connection with range as is usual in the present way.

34. Is it necessary to cover such tanks and have an escape-pipe for steam?

Yes.

35. Copper boilers have a tinned copper cold-water pipe in them; is any precaution advisable in regard to this pipe?

It should have a small hole near top of tube, say six inches below top.

36. What is the object of this?

To prevent water from syphoning out of boiler.

37. Is there any objection to placing a stop-cock beween boiler and water-back?

There is. It may be accidentally closed with dangerous consequences.

38. What is the object of a double boiler?

To obtain supply of hot water for upper and lower parts of house independent of each other.

39. What is gained by this?

That the tank supply might be reserved for upper part of house and not wasted in the lower.

40. Is it necessary to connect both boilers with water-back?

No; as the outer boiler will heat the inner.

41. If the water from inner boiler is drawn off, what danger is incurred?

That of crushing or collapsing the inner boiler.

42. Can the return-pipe be taken below the boiler?

It should not be taken below boiler under any circumstances.

43. Is there any objection to having the water pass through the water-back of two ranges?

It is sometimes necessary to make such an arrangement and is not objectionable.

44. Which is best for the pipe between boiler and water-back, lead or iron, and why?

Iron has the advantage as it resists expansion and steam-heat better.

45. What is the best size?

That depends on the sizes of boiler and range—one inch is a fair average.

46. What ill effect comes from putting the upper pipe from water-back into the boiler at a point lower than water-back?

Circulation is reversed, steam created, and consequent danger of bursting. Besides, water will not heat when pipes are so arranged.

47. Can the boiler be omitted and hot water drawn direct from water-back?

No; the danger of explosion would be always present and the storage supply insufficient.

48. What is the object of returning the hot-water service pipe to boiler?

To keep up circulation in the hot-water pipe so as to be able to draw hot water readily at every story where supply reaches.

49. Should the return-pipe be larger or smaller than the service-pipe?

It should be smaller.

50. Does a sag in the hot-water pipe make any difference?

It does. It impedes circulation, forms steam in return-pipe to boiler, and causes a rattling noise. It has also a tendency to burst the pipe.

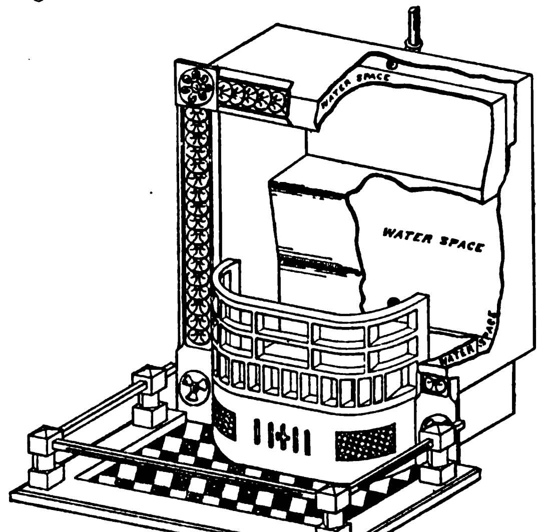
(TO BE CONTINUED.)

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

HOT-WATER GRATE.

THE accompanying illustration shows a novel arrangement of parlor grate and hot-water heating-apparatus combined, manufactured by the Philadelphia Exhaust Ventilator Co., and about to be put on the market in various designs.



It is simply a suitable open fire-place grate of appropriate design, in which the fire burns, warming the room in which it is placed, but instead of having the back, sides, and top of fire-brick tiles, they are a hollow casting which properly form a hot-water boiler.

From this boiler is an ordinary flow-pipe of a water-circulating apparatus and shown at the top in the illustration. A similar return-pipe enters the back at the bottom, and from these pipes a system of three or four coils or hot-water radiators can be warmed in a manner exactly similar to that from a regular heating boiler

Usually, the rooms on the second floor of the house can be warmed by the hot water, and when it is necessary to warm a room on the same floor as the grate, the return flow-pipe from upper floor can be carried to the heater in which it will maintain the circulation.

To one acquainted with hot-water apparatus, it is enough to say that an open-tank system may be maintained with it in any of the usual ways.

RANGE-BOILER STANDS.

THE accompanying drawings illustrate novel forms of boiler-stands patented by Mr. Allen P. Creque and manufactured by the Creque Manufacturing Co., of New York.

The simplest form of the stand is shown in Fig. 1, and is

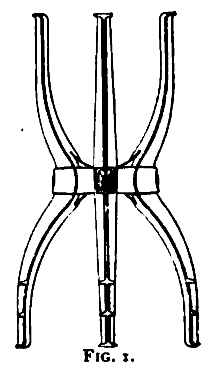


FIG. 1.

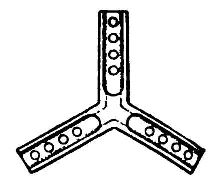


FIG. 2.

composed of three supports and a centre-connection or spider, Fig. 2. The supports are made in two lengths—the usual height of 21 inches for the common range-boiler and an extra height of 30 inches for special cases. The two sizes are similar in shape, and fit interchangeably the various forms and sizes of spiders. The lower section of the legs are provided with a number of lugs, intended for use as breaking-points, by which they can be properly shortened by breaking. The lower ends of the legs are curved outward one and one-half inches more than the reverse section, which makes the diameter of the bottom end of the stands to be always three inches greater than the top.

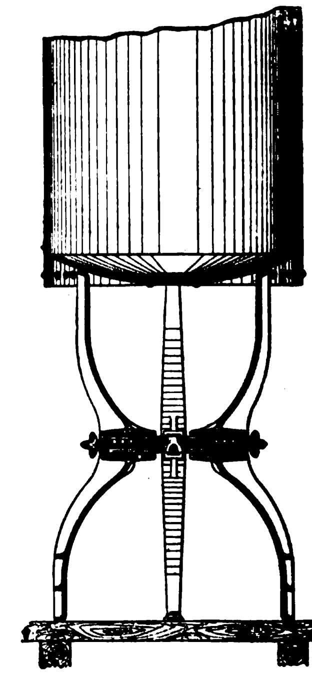


FIG. 3.

The connections or spiders are provided with three or more radial projections, according to the number of legs used, which are wedge-shaped and perforated perpendicularly with numerous holes, to afford adjustment of the diameter of the stands to adapt them to the hot-water circulators or range boilers.

Figures 3 and 4 show another form of adjustable spider connection, Fig. 4 showing the apparatus in vertical sec-

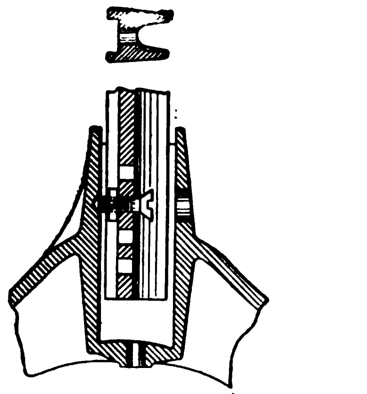


FIG. 4.

tion, and Fig. 2 being a detail through the point of fastening, showing the means of adjustment.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
March 5........	26 63	20.36	20.87	30.03	28.92	22.88	31.96

E. G. LOVE, Ph.D., *Gas Examiner.*

AT the half-yearly meeting of the Gas-Light and Coke Company of London, held on February 11, Mr. George Livesey strongly urged a reduction in the price of gas from 3*s.* to 2*s.* 10*d.* per 1,000 feet (72 cents to 68 cents). He called attention to the fact that of the fourteen gas undertakings in the United Kingdom, each of which annually used more than 100,000 tons of coal, all charged less than 3*s.* per 1,000 feet, except the Gas-Light and Coke Company, and the Alliance Company of Dublin. The South Metropolitan Company is charging 2*s.* 6*d.* per 1,000 feet, and it was urged that the Chartered Company, with its large and wealthy class of consumers, should, at least, do as well as that. Mr. Livesey believes that the surest and only way to avert a possible gas agitation is by an immediate reduction in the price. Unfortunately for the consumers of the Chartered Company's gas, Mr. Livesey found little support, and the price will remain at 3*s.*

MR. HENRY HACK, one of the Engineers of the Birmingham Gas Department, in his recent address as President of the Midland Association of Gas Managers, gave the following good advice to the younger members and those contemplating adopting gas engineering as their profession: "I would urge upon them the importance of making chemistry one of their chief, in fact, the foundation of their studies. In these times, rule-of-thumb is not likely to serve them much; and should any rely upon it, they will be deservedly left behind in the race by others who, through study and application, are ready to prove that their operations are based upon scientific principles."

THE pages of *Engineering* have recently contained an interesting discussion by Mr. D. Siemens and others, as to advantages of furnace-heating by radiation over that of heating by direct flame contact. Mr. Siemens is a firm believer in radiation.

According to the report of the Gas Committee of the Birmingham Corporation for 1886, the quantity of gas sold was 3,298,746,100 cubic feet, being an increase of nearly 4¾ per cent. over 1885. The average candle-power was 17.25.

In a recent number of the *Journal für Gasbeleuchtung* Dr. H. Krüss discusses the influence of the length of the photometer upon the photometric results. The law of light on which the photometer is constructed supposes the source of light to be a point, or, what is the same thing in practice, that the area of the luminous body is very small in relation to its distance from the screen. Practically the disproportion between the luminous surface and distance is not such as to introduce more than very slight errors at most. As to the length of the photometer there is no generally accepted standard. In England the Bunsen-Letheby photometer 60 inches long (1.52 m.), and the Evans photometer of 100 inches (2.54 m.) are usually employed. The first Bunsen photometers made by Desaga in Heidelberg, were 12 feet long, while those generally used in Germany are from 2.5 m. to 3 m. long (98.4 to 118.1 inches. Dr. Krüss proposes that for gas of from 10 to 20 candles the length of the photometers be 2.5 metres.

REORGANIZATION OF PHILADELPHIA DEPARTMENTS.

(From Our Regular Correspondent.)

PHILADELPHIA, March 8, 1887.

ON the first of next month the new charter of the city will go into operation, and in consequence changes will occur in the management of the City Departments. Under the new *regime* there will be but nine Executive Departments, the most important being those of the Department of Works and Department of Public Safety. Each of these nine departments will be under a director, who shall be the executive head thereof.

The new Department of Works will comprise the water-works and gas-works, owned or controlled by the city; the supply and distribution of water and gas; grading, paving, repairing, cleaning, and lighting the streets, alleys, and highways; the construction, protection, and repair of public bridges and structures of every kind for public use; public squares; real estate (except such used for educational or police purposes); surveys, engineering, sewerage, drainage, and dredging, and all matters and things in any way relating to or affecting the highways, footways, wharves and docks of the city.

The Department of Public Safety will take in all departments now existing relating to the police and fire affairs; all matters relating to public health, erection of fire-escapes, inspection of buildings and boilers, markets and food sold therein, or that may hereafter be established.

The Board of Health shall continue as at present, with the same powers and duties as now existing, but the number of members will be reduced to five, to be nominated by the Mayor of the city, and be confirmed by the Select Council, and the department shall be under the direction of the Director of Public Safety.

As the Mayor-elect, who then assumes office, has the power of appointment of these officers, much speculation is being indulged in as to who will be the heads. Many are the candidates, but Mr. Fitter keeps his own counsel and listens patiently to all suggestions.

City Councils have re-elected Samuel M. Smedley as Chief Engineer of the Survey Department of the city.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

BOOKS ON HOSPITAL PLANNING AND CONSTRUCTION.

PHILADELPHIA, March 3, 1887.

SIR: Can you refer me to some works on hospital planning and construction, as this is a matter I want to study?

ARCHITECT.

[The literature on this subject is very voluminous, and what one would think good another might not. On page 595, issue of November 20, 1886, is a list of books, which we supplement with the following:

Esse, C. H. Die Krankenhaüser, ihre Einrichtung wood Verwaltung. Berlin. 1868.

Galton, D. An address on the general principles which should be observed in the construction of hospitals, with the discussion which took place thereon. London. 1869.

Husson, A. Étude sur les hôpitaux, considérés sous le rapport de leur construction, de la distribution, de leur bâtiments, de l'amenblement, de l'hygiène et du service des salles de malades. Paris. 1862.

Johns Hopkins Hospital. Hospital plans. Five essays relating to the construction, organization, and management of hospitals. New York. 1875.

Mouat, F. J., and Snell, H. S. Hospital construction and management. London. 1883.

Oppert, F. Hospitals, infirmaries, and dispensaries. Their construction, interior arrangement, and management. With descriptions of existing institutions, and 74 illustrations. London. 1883.]

HOW TO MAKE BRICK FLOORS OF STALLS FOR HORSES IMPERVIOUS TO LIQUIDS.

BOSTON, March 3, 1887.

SIR: We have had more or less trouble with some stalls which have brick floors. The pitch is so slight that the urine is held and is absorbed by the bricks and straw before it runs off. We suppose that there are various washes which we could put on to make the bricks non-absorbent. Would you suggest the best thing to use? We have also heard of sheet-rubber being used in some European stables. Can you tell us of that? We fear that nothing but the relaying of the floors will do it, but would like to experiment. We hope that we do not trouble or annoy you by our questions, for it is very consoling to have some one to apply to for advice.

ARCHITECT.

[We should think you could have a layer of asphalt placed over the floors of these stalls with a proper grade so as to permit drainage. This would also be non-absorbent. Indeed, we have seen small blocks made of this that might be utilized. We suggest that you communicate with some of the people who make a business of laying floors of this material. Probably some of our readers have had some experience with the sheet-rubber referred to, and can add something to our suggestions.]

THE thirteenth annual report of the Health Department of the city of Cleveland for the year 1885, by Dr. G. C. Ashmun, Health Officer, gives the death-rate of Cleveland for the year at 17.43 per 1,000 on an estimated population of 205,000. This indicates a fairly healthy condition of the city. The proportion of deaths of children under five years was 47.59 per cent. of the total number of deaths. Dr. Ashmun remarks that "in general, the city has been cleaner during the year just closed than for several years, * * * and had the public streets been kept in as good condition as private grounds were, the real sanitary outlook for the city would have been more apparent." By this last sentence is, perhaps, meant that it would have been better.

The expenses of the health department for the year were $25,684.44. About $7,000 of this was paid for removing swill and garbage by contract, a method which, in Cleveland as elsewhere, fails to give satisfactory results.

It is properly urged that that the building of privy-vaults should be forbidden where sewers have been provided by the city. The Inspector of Sewers, Mr. George Anderson, in his report, says: "A sewer in the principal street of this city was actually laid without being connected with the main sewer, and a year elapsed before the fraud was discovered, and then only by the sewage backing up into the house."

It is not difficult to surmise what must have happened to lead Mr Anderson to make the following remark—viz.: "Health ordinances should be strictly enforced, and the officers whose sworn duty it is to enforce them should not be made to feel, when they take a case into court, that they are the parties on trial, instead of only witnesses."

PERSONAL.

JACKSON S. SHULTZ, H. K. Thurber, Walter Stanton, E. Ellery Anderson, and William E. Worthen, C. E., have been appointed by Mayor Hewitt, of this city, Rapid Transit Commissioners to lay out routes for steam-railway connections between the Elevated Roads and the ferries, south of Fourteenth Street.

COLONEL JOHN G. PARKE, Corps of Engineers, U. S. A., has been granted four months' leave of absence, with permission to go abroad.

COLONEL A. B. JEWITT, Vice-President of the St. Johnsbury and Lake Champlain Railroad, of Vermont, died in Jacksonville, Fla., March 6.

MR. WILLIAM F. SHUNK, formerly Associate Engineer of the South Pennsylvania Railroad Company, and latterly Chief Engineer to the Metropolitan and Manhattan Railroad Companies, New York City, and Mr. Andrew Bryson, Jr., recently Chief Engineer of the Hartford & Harlem Railroad, and engineer in charge of the construction of the Kings County Elevated Railroad, have formed a partnership as civil engineers for the general practice of their profession at No. 1 Broadway, New York City.

TELEGRAPHIC dispatches, as we are going to press, report the death of Captain James B. Eads, at Nassau.

DR. O. W. WIGHT, who recently resigned the position of Health Officer of Detroit, Mich., will start on a tour around the world. He will spend a part of the summer in Japan, the fall in Australia, and the early part of next year in India.

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK CITY.

Bleecker, n w cor Sullivan, 4 5-story and cellar br tens; cost, each, $18,000; o, I. S. Korn, 138 E. 47th; a, A. I. Finkle; b, not selected.

196 Bleecker, 5-story and cellar br ten; cost, $18,000; o, M. S. Korn, 138 E. 47th; a, A. I. Finkle; b, not chosen.

83–85 Elizabeth, 2 6-story br tens; cost, $20,000; o, P. H. McManus, 110 E. 9th; a, A. B. Ogden.

West, Gansevoort, 13th av and Bloomfield, 10 2 story br bldgs, known as Gansevoort Market; cost, each, $40,000; o, City of New York; a, Douglas Smyth.

84 Essex st, 5-story and basement br, Belleville stone and terra cotta stores and ten; cost, $22,000; o, Morris Rosendorff, 273–275 Grand; a, Schneider & Herter.

16 Baxter, 5-story and basement br ten; cost, $22,000; o and a, same as last.

143 Greene, 5-story br, iron and stone store bldg; cost, $20,000; o, Lippman Toplitz, 47 E. 68th; a, DeLemos & Cordes; b, day's work.

127 Henry, 5-story and basement br, Belleville stone and terra cotta stores and dwells; cost, $19,000; o, Morris Rosendorff, 273–275 Grand; a, Schneider & Herter.

34 Essex, 5-story and basement Philadelphia br ten; cost, $22,000; o, Janetta Bleistift, 245 E. 53d; a, Fred Ebeling.

2 Stanton, 4-story br store and dwell; cost, $18,000; lessee, Henry Hollmann, on premises; a, William Graul.

434 W. 49th, 5-story br ten; cost, $18,000; o, C. Callahan, 342 E. 24th; a, J. Sexton.

17th, s s, 100.5 w 9th av, 5-story Connecticut b s ten; cost, $20,000; o and b, Walker & Lawson, 842 Sixth av; a, M. V. B. Ferdon.

28th, s s, 100 w 2d av, 5-story br apart house; cost, $18,000; o, Siebrand Niewenhouse, 100 7th; a, William Graul.

28th, s s, 125 w 2d av, 3 5-story b s apart houses; cost, each, $18,000; o and a, same as last.

52d, s s, 269 e 1st av, 3 5-story and basement br and b s ten; cost, each, $20,000; o, M. & E. C. Schaefer, 529 Madison av; a, Julius Kastner.

3d av, s e cor 96th, 5-story br ten; cost, $25,000; o, Michael Giblin, 151 W. 76th and J. W. Taylor, 350 W. 23d; a, Max Hensel; b, M. Giblin, 1215 2d av.

83d, n s, 100 e 2d av, 2 5-story blue stone or terra cotta stores and tens; cost, each, $14,000; o, F. Braender, 1644 Av B; a, J. Brandt.

125th, s s, 375 e 10th av, 4 5-story br tens with stores; cost, each, $20,000; o, Harry Muldoon, 304 E. 81st; a, J. C. Burne; b, day's work.

10th av, e s, extends from 97th to 98th, 8 5-story br stores and tens; cost, corner $22,000, others $16,000 each; o, Lorenz Weiher, New Rochelle, N. Y.; a, Schneider & Herter.

6th av, n e cor 127th, 4 5-story Connecticut b s tens; cost, each, $22,000; o, James A. Frame, 107 E. 70th; a, Thom & Wilson; b, day's work.

8th av, s w cor 135th, 4 5-story Connecticut b s tens; cost, each, $18,000; o, James A. Frame, 105 E. 70th; a, Thom & Wilson; b, day's work.

125th, s s, 75 w 8th av, 3 5-story Connecticut b s tens; cost, each, $19,000; o and a, same as last.

S s 115th st, 150 ft e of Pleasant av, br factory; cost, $25,000; o, Standard Gas-Light Co; a, J F Flannery.

Washington st, n c 13th st and s w c 14th st, 2 br flats and stores; cost, $30,000 all; o, John Jacob Astor; a, Jas W Cole; b, John Jordan.

W s Jerome av, 300 ft n of 165th st, 3 dwells; cost, $18,000 all; o, Katherine and D W Bois; a, Edgar K Boune.

93–95–97 Prince st and 147 Mercer st, br store and office; cost, $150,000; o, J J Astor; a, same as last.

N e c Livingston av and 70th st, 5 br dwells; cost, $100,000; o, Jac Schmidt & Co; a, Thom & Wilson.

BUILDING INTELLIGENCE.

NEW YORK CITY.—(Continued.)

N e c Livingston av and 70th st, 5 br dwells; cost, $12,500; o and a, same as last.

116 Hudson st, br store; cost, $14,000; o, Jas and Albi Etzel; a, H M Smith & Son.

W s 28th st, 375 ft w of 9th av, br ten; cost, $14,000; o, Henry Reihl; a, Henry Davidson.

Junction Pitt and Division st, br flat; cost, $30,000; o, T M Adams; a, J G Prague.

321 E 61st st, br church; cost, $20,000; o, Soc of the Most Holy Redeemer; a, Henry Burns.

Pier 9 N R, iron freight shed; cost, $20,000; o: Sam H Seaman, Lessee; a, John Monks.

S s 99th st, 160 ft e of 3d av, br store; cost, $35,000; o, J B Smith; a, Buchmann.

N s 158th st, 117 ft e of Railroad av, fr dwell; cost, $10,800; o, Carl Muller; a, Cop Bed Plan Co.

298-300 Broome st, two br flats and stores; cost, $35,000 all; o, Jacob Raichle; a, J. Boekell & Son.

S s 138th st, 450 ft w of Millers av, Brown place, N s 137th st, 42 br dwells; cost $540,000 all; o, John C Bushfield; a, Charles Baxter.

S s 108th st, 75 ft w of Lexington av, n s 108th st, 100 ft w as above, 6 br flats and stores; cost $120,000 all; o and a, John C Burne.

127th n e c St. Nicholas av, 128th st, s e c same as last, 2 br flats and stores; cost, $48,000 all; o and a, J W Haaren.

E s St. Nicholas av, 25 ft n 127th st, n s 127th st, s s 128th st, 13 br flats; cost, $286,000 all; o and a, same as last.

Ave A n w c 82d st and s w c 83d st, 2 br flats; cost, $56,000 all; o and a, Ann Mulholland.

Av A, w s 25 ft n of 82d st, 6 br flats and stores; cost, $120,000 all; o and a, same as last.

N s 82d st, 80 ft w of Av A, 83d st, s s 2 br flats; cost, $48,000 all; o and a, same as last.

N e c 9th ave and 91st st, 4 br flats and stores; cost, $76,000 all; o, Chas M Donald; a, W L Harris.

N s 91st st, 80 ft e of 9th av, 2 br flats; cost, $35,000 all; o and a, same as last.

N s 47th st, 100 ft w of 10th av, 1 br flat; cost, $18,000; o, J W Thaden, lessee; a, Jul Kastner.

N e c Pleasant av and 116th st, 1 flat and stores; cost, $22,000; o and b, John Walker, a, J H Valentine.

N w c Av A and 88th st, 4 br flats and stores; cost, $60,000 all; o, Eva Fuller; a, John Brandt.

S s Horatio st, 125 ft e of 3d av, br stable; cost, $5,000; o, E H Adricks; a, G B Pelham.

N e c 1st av and 33d st, br factory; cost, $100,000; o, Archer & Pancost Mfg Co; a, W Shekel & Co.

W s Washington st, 518 ft n of 11th st, 2 bldgs; cost, $28,000; o, Jos Schranzer; a, Thom & Wilson.

333 E 117th st, br flat; cost, $20,000; o, Lambert Suydam; a, S Herker.

S s 76th st, 344 ft w of 11th av, dwell; cost, $20,000; o and a, A W Harris.

S s 133d st, 260 ft e of 6th av, 3 dwells; cost, $27,000 all; o, Emma Taylor; a, Jennings & Diamond.

520 E 117th st, ten; cost, $11,000; o, Francis Mitchell; a, Bernard McGurk.

ALTERATIONS, NEW YORK.

8-10 Clinton st, br church; cost, $6,000; o, Rudolph congregation; a, Charles Rentz.

541-545 W 21st st, br factory; cost, $6,500; o, Fred S Myers; a, G H Budlong.

137 Manhattan st, br shop; cost, $5,700; o, Fritz Ohle; a, Christen Alten.

2236 Third ave, br store and dwell; cost, $6,000; o, Sarah A. Freebond; a, Charles Baxter.

144-152 E 31st st, br factory; cost, $10,000; o, R M Stivers; a, W Holman Smith.

306 W 13th st br ten and store; cost, $8,300; o, John B Ireland; a, J H McCullogh.

BROOKLYN

Marcy av, n e cor Halsey, 4-story br store and flat; cost, $12,000; o and b, William Reynolds, 400 Jefferson av; a, I. D. Reynolds.

240 Stagg, s s, 105.7 e Bushwick av, 4-story fr, br filled, ten; cost, $5,800; o and b, John Times, Bushwick av, cor Stagg; a, Th. Engelhardt.

BUILDING INTELLIGENCE.

BROOKLYN.—(Continued.)

Wyckoff av, s e cor Magnolia, 2 3-story fr tens; total cost, $9,900; o, R. Meyerrose and M Brunjes, Myrtle av, cor Magnolia; a, Th. Egelhardt; b, F. Bertram.

President, s s, 90 e 7th av, 9 three-story and basement br and b s dwells; total cost, $75,000; o and b, P. Sheridan, 775 Myrtle av; a, S. Harbison.

787 Flushing av, n s, 150 w Humboldt, 1 3-story br store and dwell; cost, $6,500; o, A. D. Wellbrook, 787 Flushing av; a, Th. Engelhardt; b, W. Schlachter and J. Schneider.

S s 53d st, 170 ft w of 3d av, fr dwell; cost, $8,000; o, L V Marten; a, F Bennett.

N s 53d st, 100 ft w of 4th av, 6 fr dwells, cost, $12,500 all; o, Mrs A E Bigelow.

S e c 5th av and Lincoln pl, br ten; cost, $12,000; o, a, and b, Assip & Buckley.

N s Halsey st, 21 ft w of Patchen av, 10 br dwells; cost, $35,000 all; o and a, Cozzens & Brown.

W s N Elliott pl, 200 ft s of Auburn pl, 2 br flats; cost, $14,000 all; o, Alex Brown; a, I D Reynolds.

N w c Hudson av and Johnson st, br store and dwells; cost, $5,300; o, Mrs Evens; a, same as last.

N e c Halsey and Bedford av, br store and dwells; cost, $15,000; o, W M Hawkins; a, Irving & Belden.

S s Jefferson av, 255 ft w of Tompkins av, 4 br dwells; cost, $28,000; o, a and b, Geo H Stone.

S e c Broadway and Magnolia st, 3 stores and dwells; cost, $24,900 all; o, Bennett Estate; a, Irving & Belden.

N s President st, 167 ft w of 7th av, 6 dwells; cost, $42,000 all; o, a and b, Martin & Lee.

S s Lafayette av, 362 ft w of Lewis av, 5 dwells; cost, $32,500 all; o, Wm Andrews; a, G Glover.

S s of N 11th st, 100 ft w of Bedford av, 5 fr dwells; cost, $15,000 all; o, Wm Hayas; a, H Volweiller.

S s c Bedford av and N 11th st, 4 dwells & stores; cost, $20,000 all; o and a, same as last.

E s Bedford av, 120 ft s of Milton, br dwell; cost, $9,000; o, Chas Cooper & Co; b, Irving & Belden.

S s Fulton st, 89 ft e of Bedford av, 2 br dwells and stores; cost, $16,000 all; o, Chas Cooper & Co.; a, Irving & Belden.

S e c Bedford av and Fulton st, 4 br dwell and store; cost, $45,000; o and b, same as last.

N s of N 10th st, 125 ft w of Bedford av, 4 frame French flats; cost, $12,000 all; o, Wm Hayas; a, H Vollweiler.

E s Raddle place, 89 ft s of Herkimer st, 5 br dwells; cost, $14,000 all; o, Henry C Baker; a, T Floyd Thomas.

S s Herkimer st, 20 ft e of Raddle place, 5 br dwells; cost, $14,000 all; o and b, same as last.

W s Hopkinson av, 107 ft s of Herkimer st, 4 br dwells; cost, $11,200 all; o and b, same as last.

414 S 5th st, 1 br ten; cost, $10,000; o, Fred Frei; a, A Herbert.

N s Flushing av, 75 ft w of Humbolt st, 1 dwell; cost, $7,000; o, Henry Batterman; a, A W Dickie.

ALTERATIONS, BROOKLYN

Cor Kent av and S 3d st, br bldg; cost, $10,000; o, Havemeyer & Elder; a, Thos A Havemeyer.

140 Smith st, 1 br bldg; cost, $5,300; o, Mr Ashman; a, Maurice Freeman's Sons.

211 to 217 Ainslie st, 1 frame church; cost, $6,000; o, Ainslie st Presbyterian Church; a, Th Engelhardt.

MISCELLANEOUS.

ALLEGHENY, PA.—Tarentum station, W P R R, 2-story br bldg; cost, $7,500; o, G Getrye, M. D.; a, Alston & Herbert; the building let separate.

Same place, 2-story fr bldg; cost, $5,500; o, J G Vogebey; a and b, same as last.

BALTIMORE, MD.—Madison av and Eutaw, 7 brown stone dwells; o and b, A A Rinehart.

Broadway, nr Bank, 3-story br school house; o, St. Patrick's Church.

BUILDING INTELLIGENCE.

920 Pratt, 3-story br dwell; o, Charles Albrecht.

Townsend and North av, 3-story br dwell; o, Hy A Birch.

1705 Orleans, 3-story br br dwell; o, Geo. W Thomas.

North av, br dwell; cost, $12,000; o, David Wilson; a, W F Weber.

CHICAGO, ILL.—Dearborn av, near Lincoln Park, rock-faced dwell; cost, $16,000; o, C R Corbin; a, F B Townsend; b, V Falkenau.

1416 Wabash av, br livery, flat, and laundry bldg.; cost, $25,000; o, F H Ray; a, Edbrooke & Burnham.

Ohio and Wells, 4 br st and flats; cost, $22,000; o, E J Lehman; a, Treat & Foltz.

Cor Fremont and Center, br st and flats; cost, about $10,000; o, S T Johnsen; a, W W Boyington.

1326–32 W Polk, br dwell; cost, $11,000; o, Chapman Brothers.

99–101 Laflin, br dwell; cost, $11,000; o, Dr. E W Lees; b, C F Holman.

(Continued on Supplement.)

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 16. PUBLISHED EVERY SATURDAY.

NEW YORK, MARCH 19, 1887.

LONDON, APRIL 2, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA.

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*

SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

A NEW METHOD OF SEWER-VENTILATION.

UNDER the above heading the London *Lancet* gives an editorial notice of a patent system of ventilating sewers which, it says, "has the merit of originality and ingenuity." This may possibly be meant as deeply-veiled sarcasm. At all events, after reading the description of it as given by the *Lancet*, this is the most charitable interpretation which can be given of such a notice. It is as follows:

"Mr. R. S. Ash has patented a system of ventilation by the force of concussions resulting from explosions automatically produced. In the manhole of a sewer, or in the ventilating-shaft of a coal-mine, etc., he places a small cylinder where coal-gas accumulates till it reaches a little hole, and there comes in contact with a jet burning outside. An explosion results and the lid of the cylinder is blown off, but counter-weights make it fall back in its place, so that all is ready again for the next explosion. Of course the air is blown out of the manhole, and a vacuum created and filled by the air rushing up from the sewer, but this displacement is not the principal merit of the process. A ventilating-fan or revolving wheel and a furnace will equally produce a current of air; but such current generally travels down the central and main sewers, and leaves almost untouched the accumulations of foul gas in the branch sewers, in the angles, and in other inaccessible places. A shock, however, does not travel in a straight line, but spreads out in a circle. A stone thrown into a pool of water affords the readiest illustration of this fact. Let the edges of the pond be jagged and angular, the ripple will travel up every little crevice or opening in the banks. A current, on the other hand, even the current of a rapid stream, leaves quiet nooks made by the recesses of the embankment, where a boat may be safely moored without risk of its being borne away. Thus, an explosion in a sewer will with more certainty move the air in the branch sewers and out-of-the-way passages than will a strong current down the main channel."

Nothing could well be more absurd than the plan proposed, but the burlesque argument which the *Lancet* brings forward in its favor will no doubt be mistaken for serious reasoning by some who do not see the joke, and it would have been better if the editor had explained in a foot-note the difference between a wave and a current in an elastic medium, the one causing a vibration of particles without material change of place, while the other produces movement in one direction. According to the principles laid down by the *Lancet*, a change of the air in the lungs would be better effected during an attack of hiccups than during ordinary respiration, and therefore the best way of treating asthma would be to smoke explosible cigarettes, or what might be termed "steady-by-jerks therapeutics."

THE PRESIDENCY OF THE NEW YORK CITY BOARD OF HEALTH.

MAYOR HEWITT is to be commended for the appointment of Mr. James C. Bayles to the position of President of the New York Board of Health. Mr. Bayles is favorably known to many of our readers as the Editor of the *Iron Age* and the *Metal Worker*, and the active interest he has for many years taken in questions of sanitation is well known to his contemporaries. He has made a personal study of questions of domestic and town sanitation, and as a member of the Sanitary Association of Orange, where for a number of years he has lived, he has done not a little to secure the adoption of a sewerage system for that attractive suburban locality.

Mr. Bayles is not a politician as the term is understood by the rank and file of local political organizations. Though he has permitted the use of his name as a candidate for the place, he did not need the position as means of livelihood, having been, since he left the army at the close of the war, successfully engaged in journalistic work, and in no sense dependent on political favor. His interest, however, in the cause of sanitation has been shown by his contributions to various sanitary associations, to the columns of his paper, and by his work on "House Drainage and Water Service." We have therefore reason to believe that he will faithfully and intelligently do all that he can to restore the Board of Health to its old-time efficiency and to secure for it a return of that public confidence which is so important to a department having such ample powers and discretion. His contemporaries will doubtless do all they can to sustain him in the responsible and difficult position he has been called upon to fill.

THE ACCIDENT ON THE BOSTON AND PROVIDENCE RAILROAD.

FROM our correspondent on the ground within a few hours of the accident we have received the brief account given below of the probable cause of the failure of the bridge. The two hangers mentioned were those at one of the hips of the truss (as shown by a sketch sent us), where the upper chord and the inclined strut are joined by a casting through which the pin supporting the hangers passed. These hangers appear to have been made of a flat bar folded over at each end and welded to form eyes for the pins through the hip above and the floor-beam below.

When the wreck is cleared up and a better idea obtained as to the position in which the trusses fell and other important points determined, it may be possible to gain an intelligent view of the cause. From the rough pictures published in the Boston *Herald*, there seem to be clear indications of the cars having all turned decidedly in the same direction, as though one truss had been the first to fail. Our correspondent reports:

In addition to the accounts reported in the Boston papers, I would say that Professor Swain, of the Institute of Technology, was the first to discover a flaw in the eye-rods or hangers by which one of the trusses supporting the flooring of the bridge was suspended from the main truss on the south side near the Boston end of bridge. There are two hangers, about 24 inches long 2¼x1¼ inches, that were entirely covered by the castings through which the pins were passed, so that at inspection they could not be examined without taking the part apart. Both of them were broken off near the lower eye and showed poor welds. The broken ends of one were both rusted clear across as if the break was an old one; that on No. 2 had also rust on one-half of it, the other being a clear break. This evidently shows a weak spot which may have given away by the effect of a shock from derailment or other cause. At any rate, it would appear as if the first car at the Boston end which fell struck the abutment, while its roof went ahead and dashed into the end of the next car which remained on the bank. The middle one of the five cars which went down stands up all right in the middle of the roadway below, with two smashed cars piled up in front of it and two behind it, the last being the upturned smoker.

Contractor Low is to be on hand with heavy rigging in the morning to remove the cars, when the bridge remains will be more accessible.

The bridge was on a big skew with the roadway, which accounts for the span of some 120 feet.

The stove, where a fire was said to have started, was broken off its base just at the grate, so that the body and coals are still hanging from the tie-rods which connect it to the floor.

While the cause of weakness in the bridge is being investigated another matter should not be lost sight of. The large mortality in former accidents on roads leading from Boston has probably been in a large measure due to the flimsy construction of the old passenger cars still used on these roads. The local passenger traffic on the Boston suburban roads employs a vast number of cars which are not only old, but structurally weak. These cars are liable to go to pieces completely in an accident which would do but little damage to a strongly-built modern car. The careful manner in which the roads about Boston have been managed have made accidents rare, hence the old cars have lasted beyond their time. Old-fogy ideas have prevailed in some shops, and old methods of construction have been continued. There are several roads which have large numbers of these weak (cross-framed) cars in service. When an accident does overtake them the loss of life will be frightful. The newspaper reports would lead to the conclusion that perhaps one of the cars in the Boston and Providence wreck was of this flimsy construction. While what is done cannot now be helped, public opinion should compel all cars of this construction to be destroyed.

THE water-supply of Belfast, Ireland, before delivery into the town mains after leaving the reservoirs, is finally filtered by being passed through two circular wells thirty feet in diameter, containing box-screens formed of copper wire gauze, with pitch-pine framing, and filled with cinders.

OUR BRITISH CORRESPONDENCE.

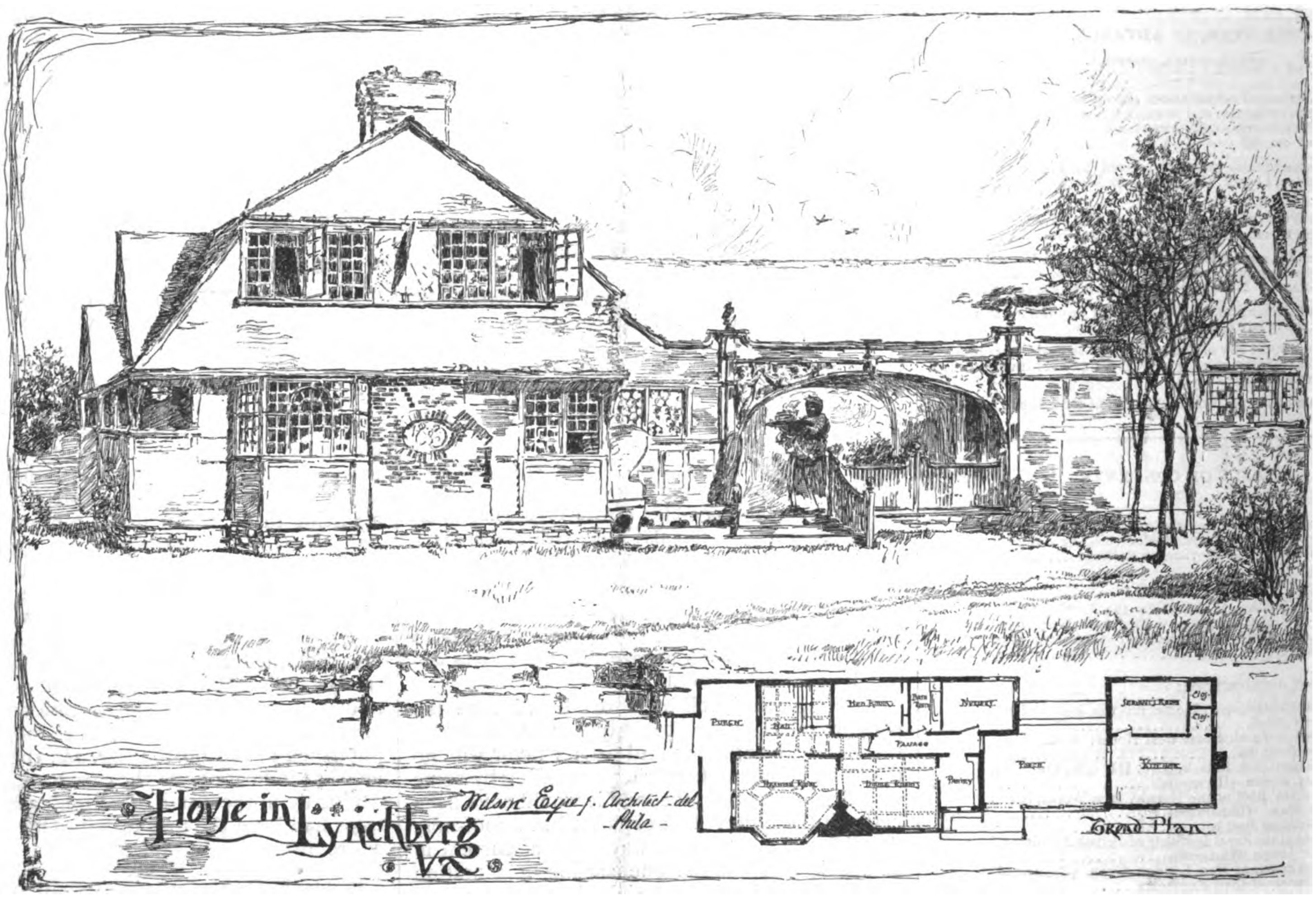
Destruction of Olive-Oil Tanks by the Earthquake in Italy—A recent Decision on Patents in Germany—The London and North-western Railway's Park at Crewe.

LONDON, March 2, 1887.

THE houses in the olive-growing districts in the north of Italy have constructed beneath them tanks in which the olive oil, the produce of the year's crop, is stored by the respective inhabitants. This peculiar feature has entailed upon the owners financial ruin as the result of the late earthquakes, the whole of the store being spoilt by débris, etc.

I would draw the attention of American patentees to the recent decision in the Court of Leipzig, Germany. It was decided by the court that foreign patents are void unless steps are actually taken to *manufacture* the article for which protection is claimed in the country. The practice which has hitherto obtained is to supply the American-made articles through a local house, but this "working" of the article is held insufficient to entitle it to protection.

The benefit accruing to a district through the maintenance of open spaces or presentation of public parks is unquestioned, and in this connection the proposed action of the London and North-western Railway Company is receiving considerable attention. This company, as a matter of fact, is the largest ratepayer in Crewe, where their works are situated, the township really being constituted by its employees and the burden of two-thirds of the rates devolving on the company. The directors propose to expend a large sum of money in presenting a large public park to Crewe. Sir Robert Rawlinson, as a shareholder, gives his fellow shareholders the benefit of his experience and authority, in questioning the justifiability of the proposal. He safeguards himself at the first by stating that he does not begrudge his own portion of the cost, but he does not think that a certain portion of the shareholders who may be unwilling to contribute should, as would be the case, be compelled necessarily to contribute. He points out that if the company pays two-thirds of the rates it should have on the local board a proper proportion of representatives to enable it to carry a resolution on the board to make application to the Local Government Board of London for the sanction of a loan for the purchase of land and for the proper preservation of same. He points out that the repayment of the cost of the land might be distributed over fifty years; that for roadmaking, draining, planting, etc., over twenty years. The necessary rates would, of course, lessen as the ratable value of the town increases. In conclusion he writes as follows: "There is under this arrangement no patronage, no injustice, no hardship; and for all time those who enjoy the park will have paid and will continue to pay for it. In Oldham, during the height of the cotton famine, the corporation bought land for their public park and laid it out by the aid of money borrowed from the Government, every farthing of which is being regularly paid back to the Exchequer Loan Commissioners, and no expenditure of money for public purposes was ever more popular in the town than this. Oldham is, however, no exception. Let Crewe, therefore, follow the example and purchase, lay out, and maintain its own public park free from an enforced levy on unwilling shareholders, a vast majority of whom will never see the park, and most certainly will never set foot in it. SAFETY VALVE.



A HOUSE AT LYNCHBURG, VA.—WILSON EYRE, JR., ARCHITECT.

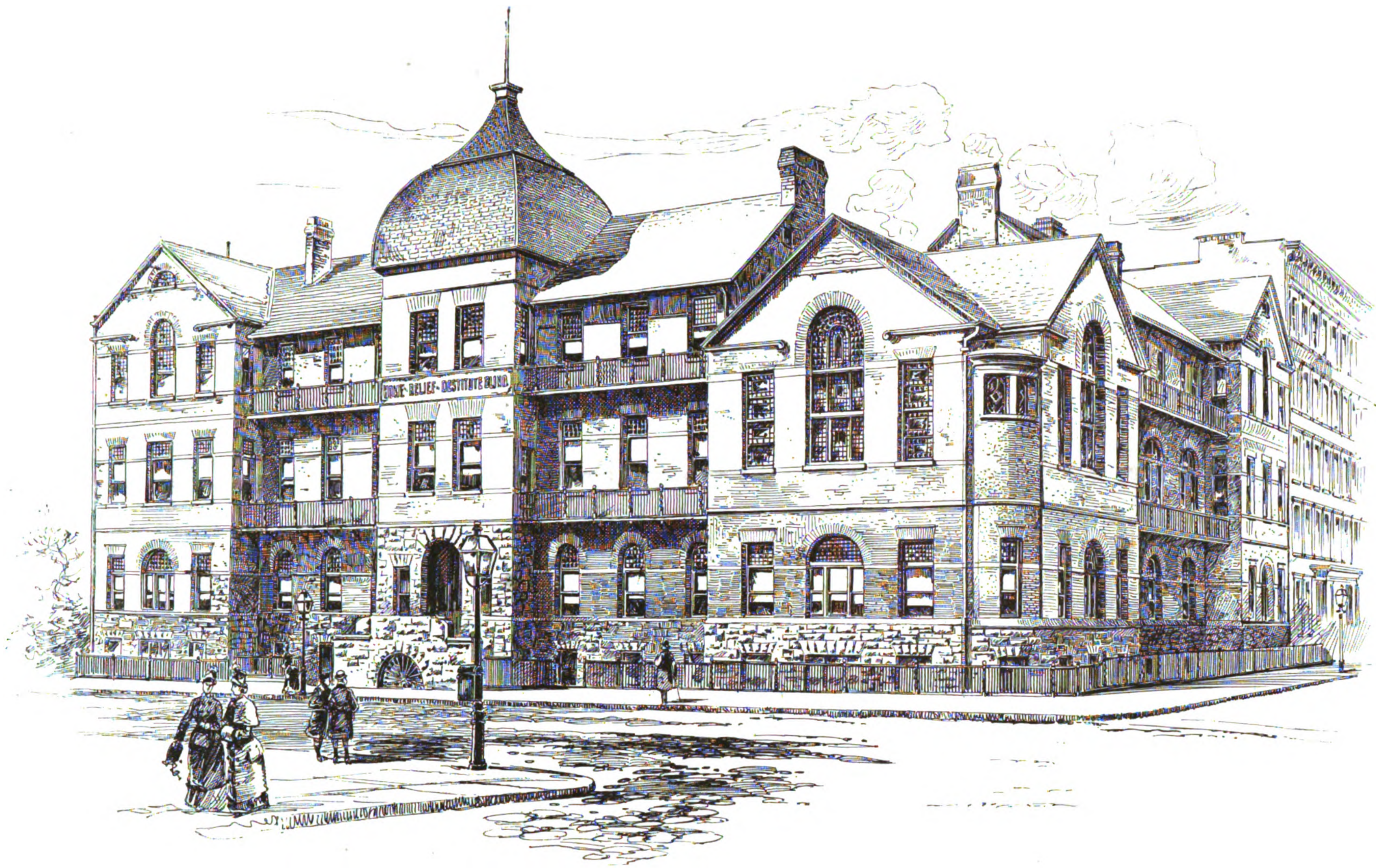
RELIEF IN RAILWAY ACCIDENTS.

THE Ohio State Board of Health has adopted the following resolution:

Resolved, That the Ohio State Board of Health deems it necessary that each and every railroad train used in traffic, within the State of Ohio, shall be supplied with a stretcher and emergency-case—contents of the case to be arranged by the surgeons of the railroad companies—to be used in event of sickness or injury, until the services of a physician can be secured.

Also, that the employees of said railroad companies be instructed in the action to be taken in case of accidents; and that a copy of this resolution be furnished, by the Secretary, to the managers of all railroads in Ohio.

A BILL has been introduced into the State Legislature providing for the abolition of the Public Building Commission of Philadelphia, and the placing the work under the Department of Works.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

HOME FOR THE RELIEF OF DESTITUTE BLIND, NEW YORK.

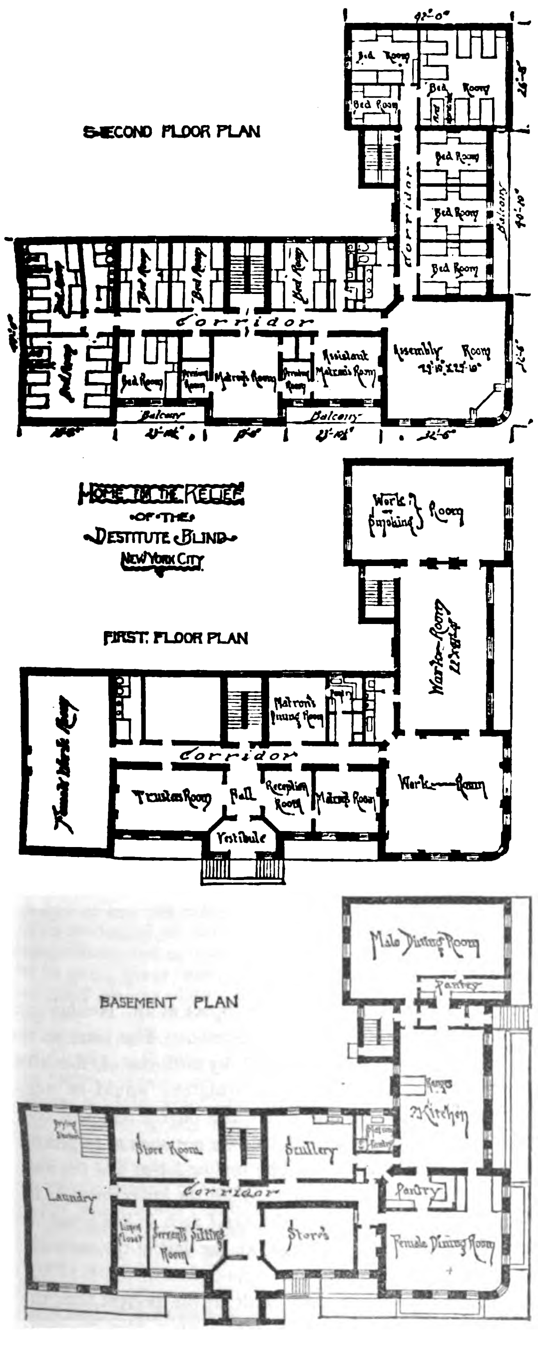
F. C. MERRY, ARCHITECT.

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

HOME FOR THE RELIEF OF THE DESTITUTE BLIND, NEW YORK.—F. C. MERRY, ARCHITECT.

THE subject of our special illustration this week is the building owned and occupied by the Society for the Relief of the Destitute Blind, located at One Hundred and Fourth Street and Tenth Avenue, New York City. The exterior is of bluestone, broken-range work, in the basement; the



remainder of hard brick, trimmed with Philadelphia brick and terra-cotta. The interior finishings are of North Carolina pine, oiled, with stucco walls. The cost of the building was $60,000. Mr. F. Carles Merry, of New York, was the architect.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A HOUSE AT LYNCHBURG, VA.—WILSON EYRE, JR., ARCHT.

OUR vignette illustration is a reproduction of a drawing exhibited at the Salmagundi Exhibition. Stone base, shingle walls, brick chimneys. Wilson Eyre, Jr., of Philadelphia, was the architect.

BUILDING CONSTRUCTION DETAILS.

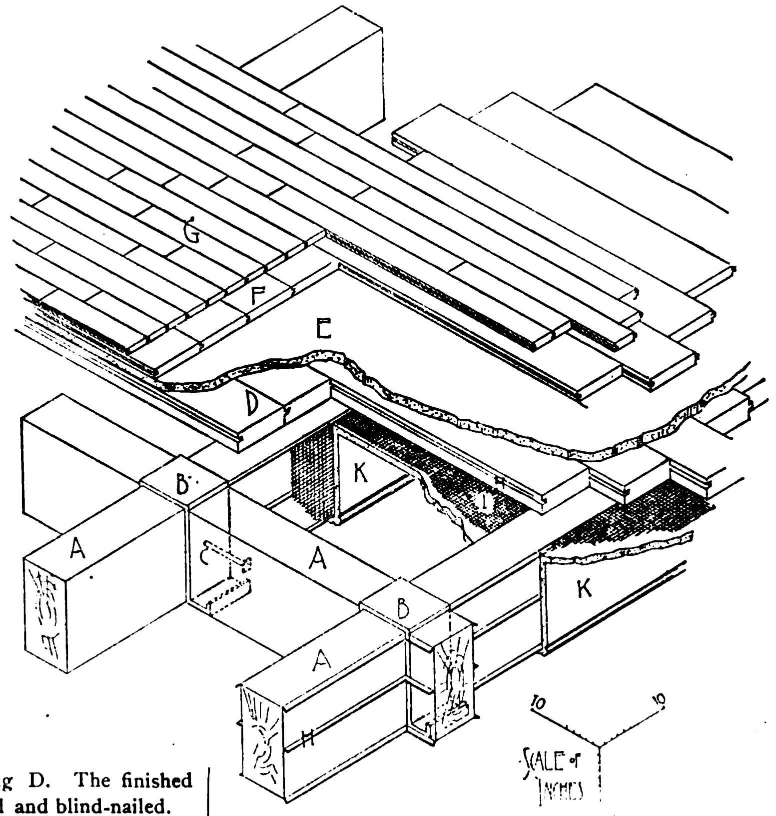
No. III.

(Continued from page 289.)

THE UNITARIAN BUILDING, BOSTON.

IN the construction of the new building for the Unitarian Association, Boston, the system known as mill-framing was adopted for all the floors and the roof, the idea being to render the building as nearly fire-proof as possible. Iron beams fail so quickly and completely when exposed to the heat of even a moderate conflagration, that though they be protected by a casing of plaster or terra-cotta, their ability to resist fire is somewhat problematic; besides, in the present instance, expense was a consideration which had to be kept in mind, still it is doubtful if a larger outlay could have secured a more complete realization of the object in view, since as it stands the construction is, for all practical purposes, believed to be absolutely fire-proof.

A wide corridor extends the length of the building through the centre, allowing for two brick bearing-walls, the spans of the floors being thus reduced to twenty-one feet or less. The floor-beams are of hard pine of uniform dimensions, 6x12 inches, spaced three feet apart. The accompanying figure will serve to illustrate this construction. A A are the timbers. Generally speaking, there was no necessity for special framing about openings, but in the few instances where cross-timbers were needed, as at fireplaces, etc., the header was hung by a wrought-iron hanger B B, made from ½-inch iron and notched under the beam flush with the face. The hanger is carried over the top of the trimmer beam and either bolted thereto or carried down the other side as a hanger for an opposite beam, as shown by the drawing. The header beam is held in place against the trimmer by a ¾-inch joint-bolt C.



Over the beams is laid a continuous floor of 2½-inch matched planking D. On this is spread a 1-inch course of lime and hair mortar E, to deaden or prevent the transmission of sound through the floor. The mortar is laid with grounds, so as to be perfectly true and even. After the mortar had set the grounds were taken up and the spaces filled with plaster. Over this is pasted a layer of building-paper. Experience has shown that in the course of time the plaster seems to disintegrate on the surface, and unless it is carefully covered with building-paper, a fine dust will rise through the joints of the upper floor boarding.

On the top of the paper is laid an under-flooring of 1¼-inch spruce boards F, matched, and nailed through the deafening to the planking D. The finished floor is of ⅞-inch oak boards, matched and blind-nailed.

In many instances where mill-framing is used, nothing further is done to the construction, the timbers being dressed and finished, but not protected in any way. In the Unitarian Building the idea of fire-proofing is carried a step farther. The under side of the planking and the exposed sides of the timbers are furred with ⅝-inch hoop-irons, H H, spaced six inches apart and secured by staples driven over the iron and into the wood. At short intervals the bottom edges of the furring strips are cut or slit out so as to form rough hooks, over which is caught the coarse wire netting I. The finished plaster, K K, is applied directly to this, clinching so effectually through the netting that the whole of the spaces between the furrings is filled completely with plaster.

It will be seen that in this way the only exposed portion of the construction is the upper surface of the finished floor-boards. Any heat acting from below would have almost no influence on the floor-beams, protected as they are by a full inch of solid plaster, and should the plaster be broken, a 6x12-inch hard pine timber would burn for hours before giving way.

The fire-proofing is carried out very consistently in other parts of the construction. The building is so simple in plan that most of the partitions could be built of brick, but where that was impracticable the partitions were made of solid plaster blocks, and the iron beams supporting them were furred with hoop-iron, wire-lathed, and filled solidly about with plaster to correspond with the floor-timbers.

The stairs are of iron, with slate treads. Where it was necessary to enclose the stairs leading to the cellar the paneling was made entirely of iron, so that the only wood or combustible material in the staircase hall is in the doors and the handrail. The walls of the hall are finished in pressed brick. Elsewhere the walls are plastered directly upon the masonry. The framing of the roof is on exactly the same system as that of the floors, except as regards the outer covering.

A very essential difference exists between this construction and that actually in use for the floors of mills and factories, for whereas in the one instance the beams are often made as light as 6x8 inches and spaced eight or ten feet apart, in a building such as that occupied by the Unitarian Association a wide margin has to be allowed for vibrations, not on account of strength, but for the comfort of the occupants. Thus, while the strength of some mill-floors is estimated at no more than 100 pounds per square foot, the floors of the Unitarian building will bear a distributed load of nearly 200 pounds per square foot.

The building was erected by Woodbury & Leighton, masons, and Andrew Anderson, carpenter, from the plans of Peabody & Stearns, architects.

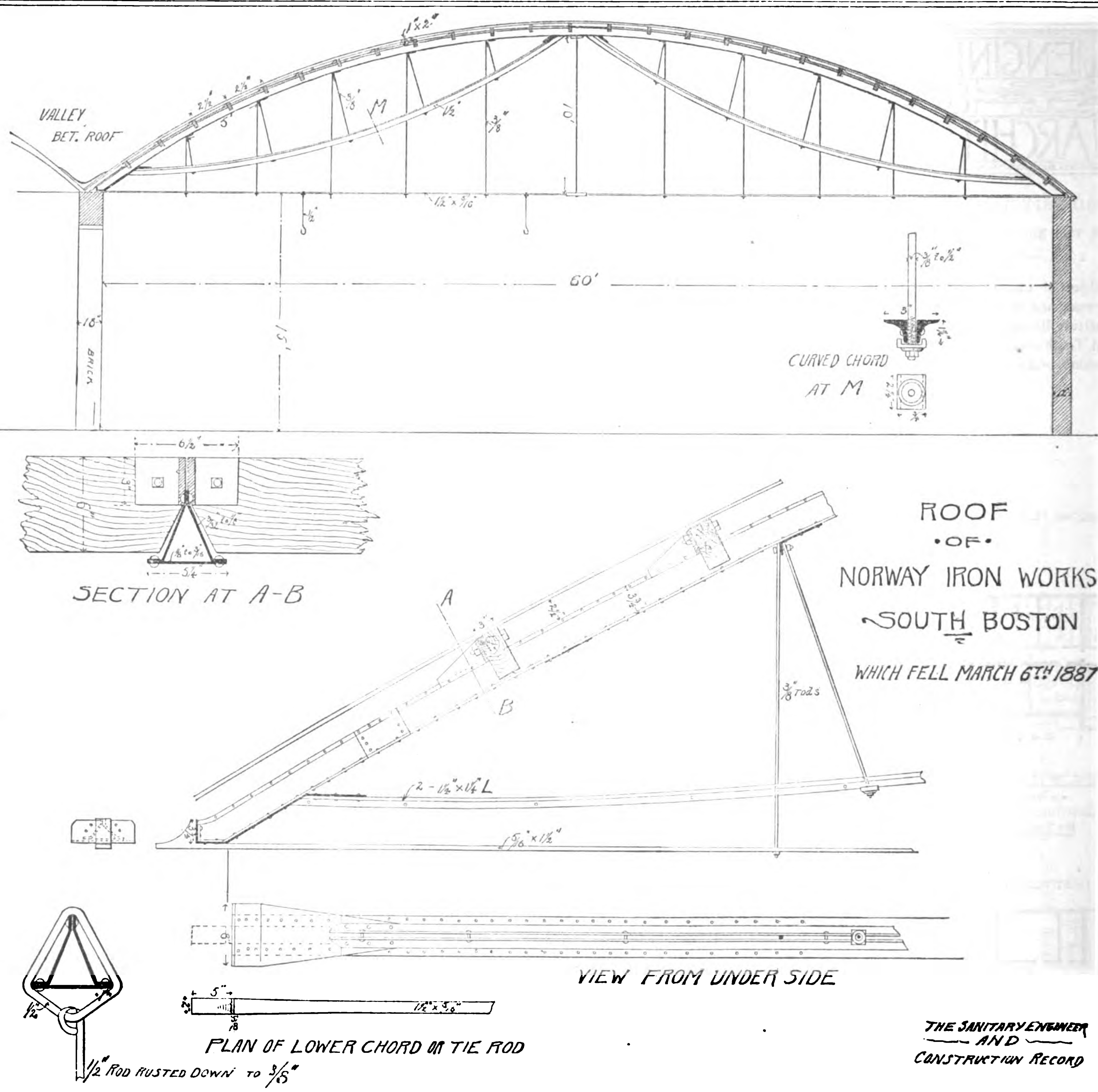
COLLAPSE OF A ROOF AT THE NORWAY IRON-WORKS, SOUTH BOSTON, MASS.

THE Norway Iron-Works, at South Boston, occupy a number of large buildings or sheds, distributed over several acres of ground situated between Dorchester Avenue and the South Bay. These buildings contain the furnaces and plant for the manufacture of plate and bar iron and steel.

The buildings have four brick walls about fifteen feet high, which support a large roof without intermediate walls or piers; the largest of them has an arched roof, with iron and timber trusses, and on the south side of it is a smaller building, with roof of similar shape resting on the same wall as the larger roof. This is the roof that collapsed on Sunday morning, March 6, at about 7 A. M.

The wall between the two shops was originally built with a certain number of doorways, but as the works were extended these doorways were enlarged, iron posts substituted for brick piers, and in several cases some of the iron posts removed and trussed iron beams put in to support the upper part of the wall on which the roofs rested.

The larger building being much wider than the other its roof was much higher. In the heavy snow-storm of Saturday night the snow accumulated in the valley between the roofs and drifted till a very large amount had been collected. On the opposite side of the smaller roof the support was only a 12-inch brick wall, and the pressure from the snow from the opposite side broke it in and the whole roof fell, leaving the walls intact.



COLLAPSE OF A ROOF OF NORWAY IRON-WORKS, SOUTH BOSTON.

It is rather surprising that this roof, which consisted of corrugated iron only for a covering, has lasted as long as it has (twenty-two years), but probably the internal heat, when the shops are working, would melt the snow sufficiently to keep it from accumulating in the valley, and the buildings on either side protect it from the wind.

The roof was about 150 feet long by 60 feet span and 10 feet rise. The trusses, if they may be called so, were 10 feet apart, and all but the first one, situated 10 feet from the front wall on the avenue, fell. The front wall extends up some two or three feet above the roof, and probably the snow did not accumulate back of it.

Each truss was formed of three strips of iron plate 5x⅛-inch to $\frac{3}{16}$-inch thick, riveted on the edges, as shown, the rivet-pitch being 3 inches. The lower plates seem to have been about $\frac{3}{16}$-inch thick and the others ⅛-inch, with cover-plates wherever the plates were joined in lengths.

Each half of this girder was strengthened by a lower curved chord, consisting of a pair of angle-irons 1¼x1¼ inches, spaced about ½-inch apart, with ⅜-inch rivets every two or three feet. This member was tied to the arch by a series of tension-rods made fast to the plates riveted to the bottom of the arch and bolted through a small cast-iron saddle under the lower chord, as shown in detail, the rods passing between the two angle-irons. A tie-rod of 1½x$\frac{5}{16}$-inch iron held the feet of the upper chord from spreading. For this purpose the ends of the tie-rod were widened out and thickened to 2x¾-inch and formed a sort of shoulder-piece to receive the end of the top chord; ⅜-inch suspension-rods came down from the upper chord to support the tie-rod.

Apparently all the suspension-rods were originally ½-inch iron, but the effect of gas and steam had rusted them down to ⅜-inch, except near the ends, which had been upset to ⅝-inch for threading.

There were a couple of 1x2-inch I-beams set between the different trusses to connect the upper chords.

The different tie-rods were connected by three or four pieces of 2¾x⅝-inch flat iron, which each carried two hangers for supporting steam and gas pipes.

There was no appearance of a single diagonal brace in the whole roof.

The different trusses supported 3x6-inch purlins, some 2 feet 6 inches on centres, which were cut to straddle the upper chords. Those on the sides were supported by angle-plates riveted to the top of the chord.

The corrugated iron was laid directly on the purlins without boarding. This is the reason that snow rarely accumulated on the roof owing to the heat in the building constantly melting it. On one of the trusses the hangers, etc., were fastened by a ½-inch rod passing around the arch as shown in the sketch.

This roof was put up many years before the institution of inspection of buildings, so that it had not come under the jurisdiction of that office.

[The account as furnished us above is not quite clear as to whether the 12-inch wall was upset at all. Neither does it mention the rupture of any tie-rods. The load on the left-hand arch would be resisted by stiffness of the latter only; the thrust caused by deformation would be transmitted to the tie-rods and other ties on the opposite side; but the connections of the latter are not such as to give the full strength of the rods. The inclined ties and the main tie, with the verticals passing through the lower chord, would seem to have held the right-hand arch in line; and the failure occurred by crippling at the left of the centre at about the point shown.

Such a roof would not be built at the present time, but a failure is always of interest as showing what to avoid. —ED.]

GYPSUM BUILDING BOARDS.

FROM *Glaser's Annalen* we learn that Julhe, in France, has made a series of experiments on gypsum with a view to using it as a substitute for boards for building purposes. He has succeeded by mixing six parts of the best gypsum with one part of recently slaked lime, which has been passed through a fine sieve, in producing a substance which can be worked precisely like gypsum. The object produced, however, if soaked in a solution of some sulphate with a base precipitable by lime and afterwards insoluble, becomes so hard that it cannot be split by a marl. The hardening is effected chemically by the filling of the pores of the gypsum with sulphate of lime (gypsum itself)

and with an oxide of the base used. By using a zinc sulphate the object remains white; with an iron sulphate the final color is red-brown. The resulting substance has twenty times the resistance to breakage of ordinary gypsum. To obtain the best results the gypsum and lime must be most carefully mixed; only just enough water to give the necessary plasticity must be used, and the object when placed in the sulphate solution must be perfectly dry in order to readily absorb the solution, which must be a saturated one. The object must not remain in the solution more than two hours. If too much lime is used an extraordinarily hard surface is produced, which is capable of taking a high polish, but the hardness is very superficial. If upon tiles made with iron sulphate linseed oil browned by heating be poured, the appearance of mahogany and a certain elasticity is produced. Copal varnish adds to the effect when mixed with the oil. A floor made with these tiles makes a polished parquet, and, for the same service as an oak floor, costs much less.

TRANSACTIONS OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

PART I. of the new series of Volume III. of the Transactions of the Royal Institute of British Architects, contains some excellent sketches by W. H. Bidlake, M. A., Pugin Traveling Student, 1885; Arnold B. Mitchell, Associate, Soane Medallist, 1885; and George T. Oakeshott, the Aldwinckle Traveling Student. Like all the other work done by the authority of the Institute, the reproductions of these sketches are particularly good and interesting. There are also illustrated papers from two Honorable corresponding members, Paul Sédille, of Paris, and Giacomo Boni, of Venice, the former on the "Revival of Colored Architecture in France," and the latter on the "Cà d'Oro and its Polychromatic Decorations." The volume is not so large as some of its predecessors, but is fully up to the high standard set by them in interesting matter.

THE LATE SIR JOSEPH WHITWORTH.

THE regular meeting of the Engineers' Club of Philadelphia was held February 19, President T. M. Cleemann in the chair, with thirty-four members and one visitor present.

Mr. John Fernie, C. E., Member Institution of Civil Engineers, Institution Mechanical Engineers, etc., of England, delivered a most entertaining and instructive address upon "The Mechanical Genius and Works of the Late Sir Joseph Whitworth."

"Full of years, of honors, of wealth, which he gained by the most unremitting toil and industry, there passed away to the majority, on the 20th of January last, one of the greatest of modern engineers.

"I first made Mr. Whitworth's acquaintance at Birmingham. Birmingham is one of the great manufacturing cities of England, standing on the edge of the 10-yard coal-bed, or what is called the black country. The abundance of cheap fuel and the energy of its people early developed it into a workshop of the most various industries, in iron, brass, silver, and copper; principally known on this side for its guns, great manufactories of glass, of lacquered-ware and electro-plate, of railway-carriages and steam-engines.

"Birmingham stands in the centre of England, geographically; politically, it has a great voice in the affairs of the nation. It is a great liberal centre, represented in Parliament by John Bright and Joseph Chamberlain; but to the engineer it has greater attractions, for here lived Matthew Boulton, who rescued James Watt from the clutches of Roebuck, and whose wealth and influence established the success of the steam-engine, and here comes in a link which unites Pennsylvania to these old times. The Lunar Society founded by Watt had three other members: Dr. Darwin, whose name will never be forgotten, the genial progenitor of the greatest philosopher of our day; Matthew Boulton and Dr. Priestly, who discovered oxygen, who studied electricity in the light of Franklin's discoveries, and who, when driven out of Birmingham by a rough mob, came over to the great State we live in and found a home and friends.

"With these advantages and this precedent, it only seemed to follow in the natural order of things that some sixty years afterwards George Stephenson and a few kindred spirits should come to Birmingham to found an Institution of Mechanical Engineers.

"Our first Presidents were the Stephenson's, father and son.

"Our next President, William Fairbairn, was one of the most distinguished engineers of his day. He may be very properly called the Father of Experimental Mechanics. He was not much of a speaker, but he was an authority on almost every mechanical subject; on the strength and form of girders, steam-boilers and tubes, on iron ships, on riveted joints, on the strength of cast and wrought iron; he was famous for his mill work, he gave us the first riveting machine, and his most famous design, the bridge over the Menai Straits, had been recently completed when he became our President.

"Joseph Whitworth, who succeeded him, was one of a group of mechanical men, who had done great work in their day; James Nasmyth, who invented and perfected the steam-hammer; James Kennedy, who made the first inside cylinder engine with its crank-shaft; Robert Napier, who made the first Cunard steamships, and John Penn, a great marine engine builder. All these men, except Mr. Nasmyth, became our Presidents, and Mr. Whitworth, though physically the weakest in health, survived them all, except Mr. Nasmyth who still lives in Kent at a good old age.

"Joseph Whitworth was trained in a cotton-spinning machine shop in Manchester, and when he had finished his apprenticeship he went to London to get a better knowledge of his business than he could get in Lancashire. Those who have studied the life of Watt will remember that he did the same thing. So, in later years, Mr. Nasmyth tells us in his delightful Autobiography, how he went to London to improve himself in the mechanic art, and what he learned at Maudsley's, and what exquisite work was made there. Joseph Whitworth, employed as a workman, soon distinguished himself by his skill, and was for some time employed in Mr. Maudsley's private workshop, where his finest work was done.

"It was as a working man, fighting his way upward in the world, that he made his greatest invention, how to make a true, plane surface. The reasoning out of the process by which this was effected, 'the superposition of three different planes and the cutting away of the higher points by a scraper, as compared with the old plan of filing and grinding, brought about a revolution in the workshops of the world,' was most astonishing as the work of an uneducated man, for what the ancient mathematicians supposed and dreamt about, 'a perfect plane' this man accomplished while toiling at his bench in Maudsley's workshop.

"Mr. Whitworth, after leaving Maudsley's, was employed at Holtzapfel's & Clement's Works, and it was in the latter that he was employed on Babbage's famous calculating machine.

"Having perfected himself as a workman, he now started in Manchester as a tool-maker, and very soon made his name known as one who only did the very best work. No one could have started at a more opportune time. Railways and steam-boats were developing all over the world, and good tools could hardly be made quick enough, and he very soon realized a large fortune. It would be impossible for me to tell all that he did in the way of his improvements in tools, and I hasten on to his improvements in screw-threads.

"Mr. Whitworth was early impressed with the idea, that if it were possible for all engineers to use the same sized taps and dies, not only a very great saving would be effected, but all work would be much better done. He, therefore, made a collection of all the screw-threads of the different firms in England, and from these laid down a system which was a compromise of them all, was at once adopted by the railways, and very soon became as universal as if it had been by an Act of Parliament. Only those who remember the chaos which existed before Whitworth's system came into use, can have any idea of the confusion and waste of time and money which existed when everybody had their own thread and pitch, and declared that 'theirs was the best in the world.'

"Mr. Whitworth's next great work was in establishing a system of fine measurement. To the great exhibition of 1851 he sent a measuring machine, capable of measuring to the one-millionth part of an inch, and some years afterwards, in a paper read at the Institution of Mechanical Engineers, advocated the adoption of the inch as the standard of measure for all mechanical engineering work, and that, instead of dividing it into eighths, it should be divided into tenths, etc. I may here briefly state that I was the first to adopt this system. I did my fine measurements with a machine after my own style. I proved that the system he sought to establish was a practicable one, and my adoption of it, as an independent worker, perhaps brought it quicker into general use.

"Mr. Whitworth had now accomplished the following great improvements in mechanical science:

"*First*—His plane surface.

"*Second*—His system of uniform screw-threads.

"*Third*—His system of fine measurement.

"Mr. Whitworth was now called by the War Department to undertake a series of experiments on the best form of rifle to be used in the army. These experiments, which were the most valuable and exhaustive of their kind, led him to adopt a rifle with a very small 6-sided bore, the corners of which were rounded, a very quick twist of rifling and a steel barrel. With this rifle he obtained the lowest trajectory, and the greatest penetration with the smallest quantity of powder consumed, and he presented it to the Government, charging nothing for his labor. The Government did not, for various reasons, accept his rifle, and he then proceeded to apply the same principles to artillery.

"Again he was able to prove that the principles he had applied to the manufacture of rifles was a right one for artillery, but the Government would not accept his artillery and he would allow no alteration in his designs, and the guns of Sir William Armstrong were adopted.

"It was during his experiments on rifles that he was led to manufacture steel. He very soon found that iron could not be depended upon for his barrels, and he found so much variation in steel from the makers that he determined to investigate it, and built a small steel-works where he could carefully test, under his own eye, the steel best suited for his work. He adopted a mode of testing his samples which was all his own. His samples were cylinders, some four inches long, bored and turned to gauge, a measured quantity of powder was placed within them, the ends were secured in a hydraulic press, and the powder discharged by electricity, and this process was continued till the sample burst.

"His experiments on steel led him to adopt a system of casting steel under compression, which he patented, and to the improvements of which he devoted the last years of his life, and from which he expected the greatest results. So satisfied was he of the value of this invention that, when approaching his eightieth year, he determined to build large new steel-works outside the city of Manchester, using for that purpose a large sum of money he had obtained from the sale of his old works in Manchester, which, being in the centre of the city, had become very valuable.

"At the last great exhibition in Paris there were some samples of steel forgings, the like of which had never before been seen. They consisted of a heavy intermediate shaft for a screw-propeller, and two liners for the steam-cylinders of a steamship. The shaft was cast hollow and was partly turned to show how beautifully true it had been forged, and there appeared to be literally nothing required to be turned from it. So it was with the liners; these were not from the great forges of Yorkshire, or from the great steel-works of Krupp; they were the work of an old infirm man close on to eighty years of age, who knew nothing about forging till over sixty, but who, when young, commenced by making everything he did as near perfect as it was possible, and who leaves as his monument the most perfect, the most novel forgings ever produced.

"Mr. Whitworth deeply felt the want of a good education, and many years ago gave the sum of £100,000 to provide a fund for the mechanical training of likely young men. For this he received from the Government a baronetcy, but he left no sons to succeed him in his title. He died as he lived, working and toiling to the last. My acquaintance with him goes back for some thirty years, when I served with him as a member of the Council of the Institution of Mechanical Engineers at Birmingham, and was continued up to some five years ago, until my coming to this country. I esteemed him highly and think he was the greatest mechanic of our days."

RECENT SEWER CONSTRUCTION.

No. III.

INTERCEPTING SEWERS AT NEW LONDON, CONN.

THE intercepting sewers in New London, Conn., which have been in process of construction during the past summer and are now about completed, are the first sewers built by the city for the reception of house drainage.

Lines of pipe sewers, aggregating about 7,600 feet in length, have been built by private parties from time to time, in a more or less imperfect manner, and usually eight inches in diameter, but with no attempt at uniformity of plan, and discharging into the nearest convenient place.

The necessity of a system of public sewers has been agitated since 1879, when a drainage survey was made by W. H. Richards.

Col. George E. Waring, Jr., reported to the State Board of Health in 1880.

In 1885 Rudolph Hering was engaged by the Committee on Health of the Common Council to make a report and plan of sewerage, and Mr. Hering's plan was adopted by the Board of Sewer Commissioners, organized in April, 1886.

The location of the intercepting sewers is similar to that proposed by the other engineers, with important changes in detail.

The main portion of the city is situated on the sides of a cone, rising from the harbor on the east, and inlets on the north and south to an elevation of about 125 feet above datum at mean high tide, and the intercepting sewers are built around the base of this cone along the water front, so as to receive the lateral sewers in all directions. (See map.)

As the contour is such as to quite readily carry off the surface-water in gutters and existing drains, the intercepting sewers are designed to carry house-drainage and roof-water only.

The place selected for the discharge was the point running furthest into the harbor and about midway between the ends of the intercepting sewers, this being the most favorable point to enable the discharge to be made by gravity; the low ground at each end necessitated grades ranging from 2 : 1,000 to 1 : 1,000, about 4,200 feet of the larger sewers being laid on the latter grade.

The cutting varies from 22 to 2½ feet. In the deep cutting of the southern sewer, which was in fine sand, and of the northern sewer, which was in rock, much difficulty was experienced from ground and tide water.

The larger portion of the sewers are of vitrified clay pipe from 24 inches to 12 inches in diameter, but a part of the southern sewer came so near the street surface that a brick-sewer, with flat stone top, as designed by Mr. Hering, was adopted (Fig. 1).

This part of the sewer was built of one course of brick, backed with rubble masonry in mortar, covered with gran-

ite six inches thick, is 20x20 inches in section, and in places the invert is within two feet six inches of the street-surface.

The pipes were subject to a rigid inspection for concentricity and evenness of surface, and were laid with neat cement joints and in some cases with gaskets. The branches were all six inches in diameter, and in the deep cutting were extended to within about ten feet of the surface.

All changes of grade or direction are made in manholes (Figs. 2, 3).

A large manhole at the junction of the two intercepting-sewers is arranged to ultimately accommodate two outfall-sewers, but one being needed at present (Figs. 4, 5).

A portion of the outfall-sewer under a wharf, being partly above ground and exposed to the action of the tide, is laid in concrete (Figs. 6, 7).

As the crown of the outfall-sewer is on a level with mean high tide, a galvanized cast-iron tide-valve is placed at the end of the permanent sewer to prevent a back flow at high tide (Figs. 6, 8, 9). A temporary wooden pipe, resting on piles, extends from this point 106 feet to deep water at the end of the wharf (Figs. 6, 10, 11).

This wooden outfall-pipe is built of 3-inch cypress plank, sawed on the radius of the circle, banded together with galvanized wrought-iron bands, and is coated inside and out with tar. It terminates with a square wooden well, discharging below low water, but arranged with a weighted gate which can be opened when desired, to discharge floating matter (Fig. 12).

It is intended to substitute a cast-iron pipe (extending beyond the end of the wharf to the channel) for the wooden structure whenever the discharge at the present location becomes offensive (C, Map).

The sewers were built by the Board of Sewer Commissioners, Rudolph Hering being consulting engineer and W. H. Richards engineer in charge. The contractor for furnishing pipe was M. S. Austin, of New Britain, Conn., and for laying pipe and trenching, P. F. Brennan, of Waterbury, Conn. The pipe was made by Anderson Bros., of Anderson, W. Va.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

WE congratulate the engineers of Canada on the success which has met their efforts to form a society on the same lines as the Institution in England and our Society of Civil Engineers. In one year from the date of the first meeting a society of 280 members has been thoroughly organized, and we learn a determination expressed to apply for an act of incorporation for the whole Dominion. The headquarters were chosen by sealed ballot, and resulted in the selection of Montreal by a majority of 72 to 22 over Ottawa, the capital of the Dominion.

The meeting on the 24th of last month was attended by nearly seventy gentlemen, and was thoroughly representative of the profession. The ballot for officers was conducted on the same principle as that of the American Society of Civil Engineers. It resulted in the selection of Thomas C. Keefer, C. M. G., as President; Walter Shanly, M. P., Montreal, Colonel Gzowski, Toronto, and John Kennedy, Montreal, Vice-Presidents; Professor H. T. Bovey, Montreal, Secretary-Treasurer; Alan Macdougall, Toronto, H. F. Perley, F. N. Gisborne, Ottawa, H. D. Lumsden, Toronto, W. L. Poole, Stellarton, N. B., Hurd Peters, St. John, N. B., S. Keefer, Brockville, W. T. Jennings, London, H. N. Ruttan, Winnipeg, P. W. St. George, E. P. Hannaford, H. Wallis, Professor Bovey, L. Lesage, and P. A. Peterson, Montreal, Council. A most enjoyable *conversazione* was held in the Redpath Museum of the McGill University at the invitation of the resident members, the venerable President, Sir William Dawson, F. R. S., Mr. Curran, M. P. for Montreal, and John Kennedy, V. P. C. Soc. C. E., delivering addresses of welcome. There are 280 members on the roll, of which nearly eighty are students. We give the new society our heartiest good wishes, and compliment the promoters on the success which has crowned their efforts.

The new society has our best wishes for its prosperity, which feeling we feel soon will be entertained of the profession in the United States, and the promoters are to be congratulated on the successes that has thus far followed their efforts to benefit the profession in Canada.

CAPTAIN CHARLES E. L. B. DAVIS, U. S. Corps of Engineers, in his report on the work in the harbors on Lake Superior, Green Bay, and on the western shore of Michigan, gives details of the work done on the various harbors, which consists mostly of dredging and the building of piers for the protection of shipping. It is to be noted with commendation that a wise discretion has been exercised in the prosecution only of such work as is actually needed, and that harbors having no commerce are reported against. The last item is a report as to the improvement of Ashland harbor on Lake Superior, one of the rapidly growing ports in that region.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

REPORT OF TEST OF STEAM-HEATING OF RAILWAY-CARS BY THE CHICAGO, MILWAUKEE AND ST. PAUL RAILWAY COMPANY.

IN response to request for report of tests we received the following:

CHICAGO, MILWAUKEE AND ST. PAUL R. R. CO.,
GENERAL MANAGER'S OFFICE,
MILWAUKEE, March 10, 1887.

SIR: In response to your request of the 26th ult., I take pleasure in enclosing to you copy of report of our Engineer of Tests as to experiments tried by us during the month of February of this year on our Chicago and Milwaukee and River Divisions with the Martin system of heating trains by steam from the locomotive.

The experiment was made with a train of a baggage-car, three coaches and parlor-car. Unfortunately, we did not get the apparatus in time to subject the system to the test of our ordinary severe winter weather, which alone will determine its practicability for our climate.

Yours truly, ROSWELL MILLER, General Manager.

CHICAGO, MILWAUKEE AND ST. PAUL R. R. CO.,
TESTING DEPARTMENT,
MILWAUKEE, March 9, 1887.

MR. R. MILLER, General Manager.

SIR: Replying to your request for report of tests of apparatus for heating passenger trains by steam from the locomotives:

The system is that devised by William Martin, of Dunkirk, N. Y. This system is on trial with the Boston and Albany Railway, and it would probably be superfluous to give a detailed description here. I may say that its essential features are:

First—A peculiar form of metal coupling between the coaches, which coupling allows of expansion and contraction by sliding metallic sleeves and motion around curves by means of metal knuckle-joints.

Second—A steam-trap under each coach which allows escape of water of condensation while retaining the steam.

Third—The use of a reducing-valve placed in the locomotive cab to prevent undue pressure in train.

We have some 270 feet of 2-inch piping in each coach to supply radiating surface. These pipes are arranged along the truss-planks on either side, with a dead end under each seat, and each coach has proper globe-valves to allow for pressure regulation in each independently. The performance of this system I presume is what is of special in-

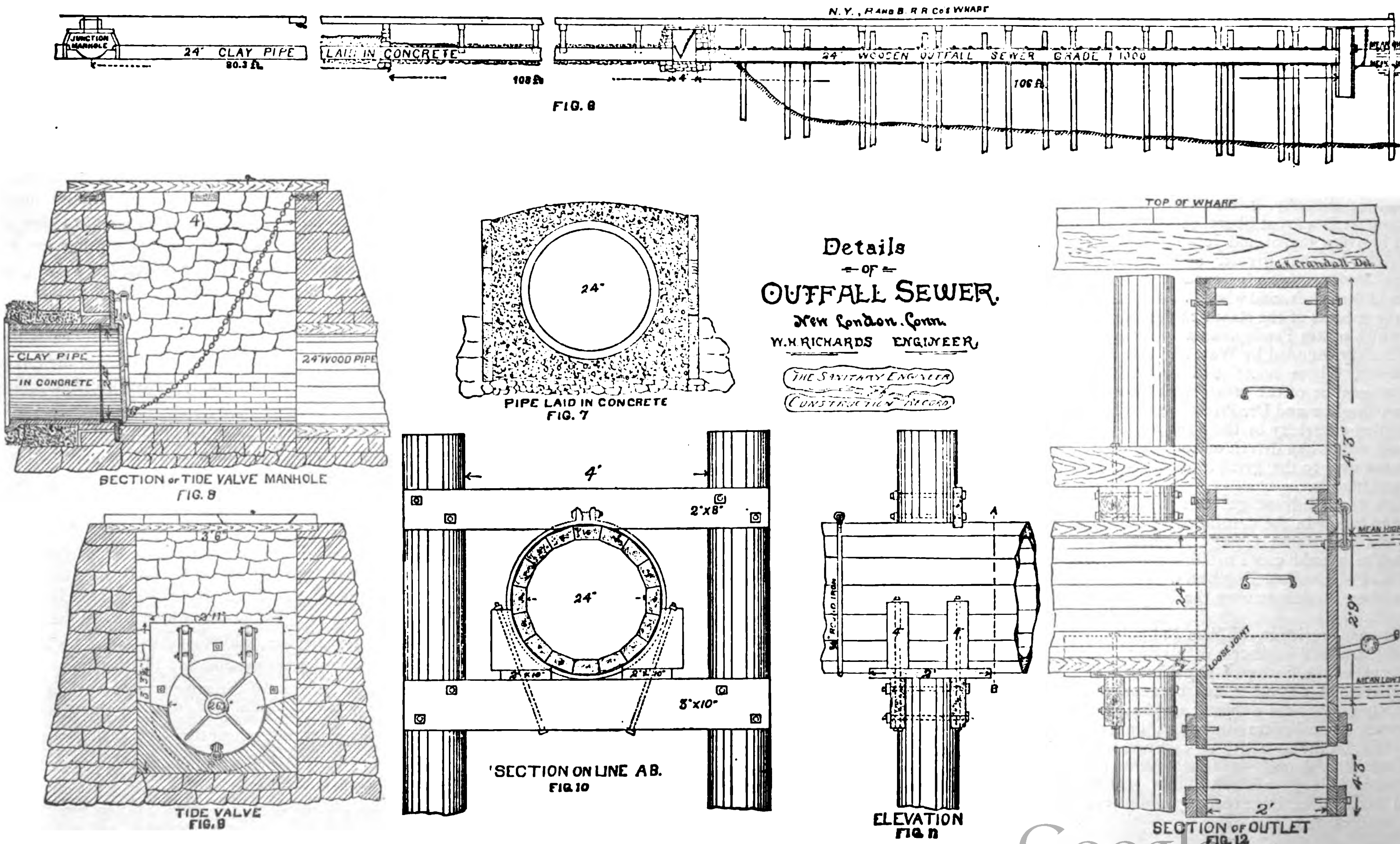
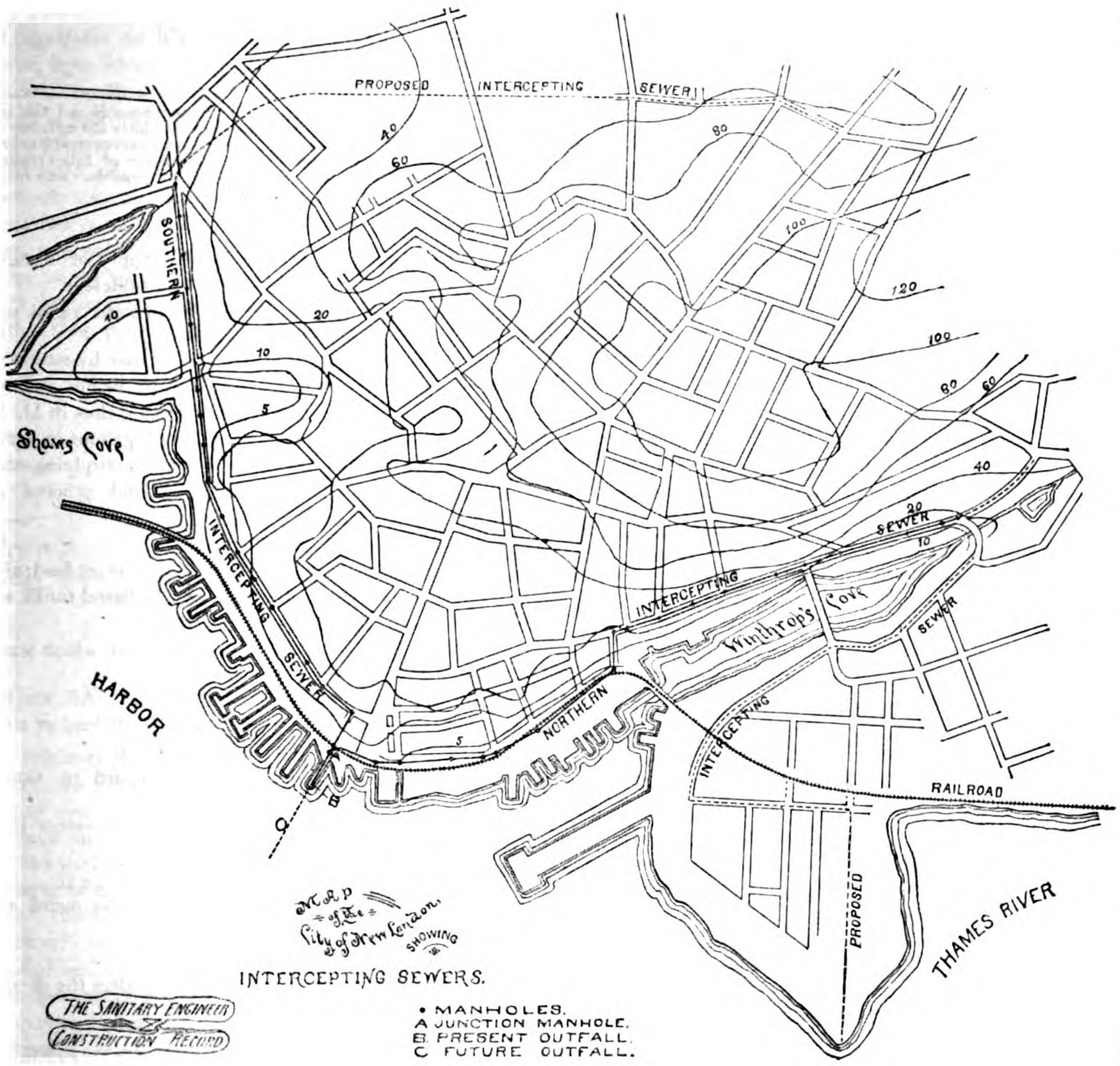
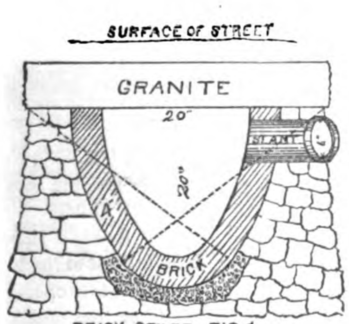
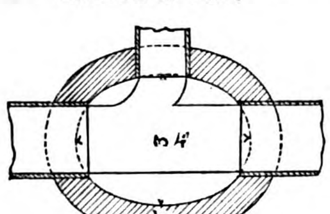


FIG. 6
SECTION OF TIDE VALVE MANHOLE FIG. 8
PIPE LAID IN CONCRETE FIG. 7
TIDE VALVE FIG. 9
SECTION ON LINE AB. FIG. 10
ELEVATION FIG. 11
SECTION OF OUTLET FIG. 12

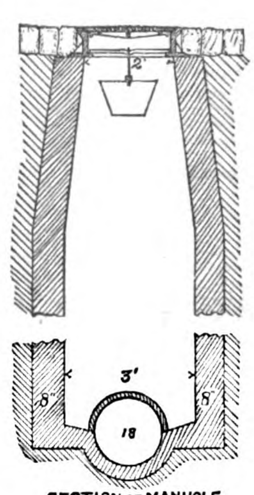




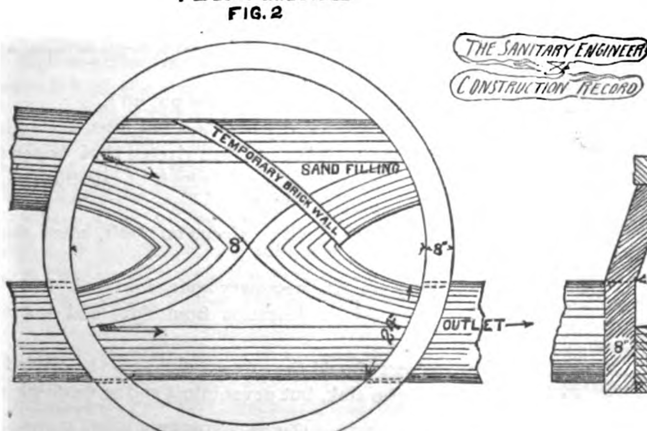
BRICK SEWER FIG. 1



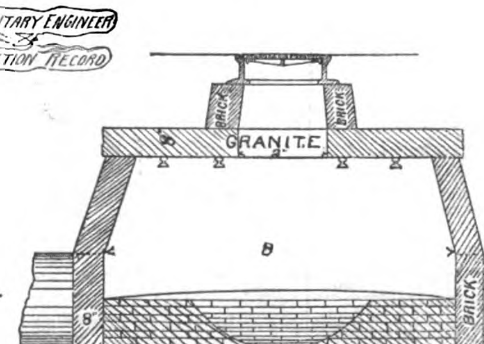
PLAN OF MANHOLE
FIG. 2



SECTION OF MANHOLE
FIG. 3



PLAN OF JUNCTION MANHOLE FIG. 4



SECTION OF
JUNCTION MANHOLE
FIG. 5

terest now. In this respect we have been disappointed in not getting sufficiently severe weather for a crucial test. The weak point in all systems using steam or water is the tendency to freeze at all exposed places; these, in a steam-heating plant, are the valves, traps, and couplings.

We experience very low temperatures (30° or lower, with high winds) for considerable spaces of time in winter on our lines, so that it will be seen that the above points are of great importance here. As regards actual results, with a temperature above zero, when carefully watched, the traps and valves can be kept reasonably clear of ice, but a neglect to open drainage-cocks has already resulted in trouble in quite a moderate temperature. The couplings have also given some trouble by leaking on the air-brake couplings. My own opinion is that we shall have to devise some means of better protection for traps and couplings.

In regard to heating effects: These have been very satisfactory so far as we have gone (that is, below zero temperature).

In regard to amount of steam used: This is a very important point when engines are already taxed in most cases to their full capacity. We have made arrangements on this train (consisting of five cars) to catch the condensed water, which gives in a measure the amount of steam used, and we find the quantity is quite large—much larger than is claimed by inventors in this line. On a quiet day, with temperature 15° above, we condensed 100 pounds of steam per car per hour. This would probably amount to between 8 and 10 per cent. of the steaming capacity of an ordinary passenger engine drawing a train of ten cars.

I will not enter here into the difficulties of operating a continuous heating system, to provide for heating coaches on mixed trains, or cars cut off at way stations, or in cases of trains caught in snow blockades, but the retention of some form of individual stove or heating-apparatus appears to me to be unavoidable as an auxiliary.

In conclusion, I can only say that the system is by no means a demonstrated success. A decisive trial must be made under the usual running conditions, and these are only to be met with when we have a spell of our ordinary severe winter weather. Yours very respectively,

(Signed) GEORGE GIBBS, Engineer of Tests.

[It is some satisfaction to notice that Mr. Gibbs' experiments confirm our estimate of the amount of steam per hour condensed to warm a car. In our issue of January 29, we went into this matter fully, and gave the figures to show that the condensation as well as the percentage of steam used, which we showed to be seven per cent. at the ordinary rating of a first-class passenger locomotive.]

INCREASING MOISTURE IN ROOMS.

IN a recent communication to us Mr. Henry R. Towne, President of the Yale Lock Manufacturing Company, at Stamford, Conn., says:

"As to my method of using steam for increasing the moisture in rooms, I will explain as follows:

"My house is heated by an indirect steam apparatus. Soon after building it I ascertained, by using a Mason's hygrometer, that in winter the air in the house was very dry, the humidity ranging as low as between 30 and 40 per cent. of the dew point. Many sanitary authorities agree that 60 per cent. humidity is desirable for health, and my personal experience seems to confirm this view. I thereupon endeavored in various ways to raise the percentage of humidity. I used evaporating-pans and porous cups in front of the registers. Experimentally I tried wet cloths hanging from pans of water, which, by capillary action, gave considerable evaporation. All of these devices combined, however, failed to increase the moisture more than from 5 to 10 per cent.

"Finally, I made a small connection in one of the indirect steam-coils whereby I could admit a small jet of steam into the air-box just under the coil. I at once found that this enabled me to raise the humidity to any desired point, the limit practically being that at which condensation on windows occurs. Since then I have had this arrangement applied to two of the coils on the main floor of my house, with the stems of the steam-valves of the arrangements carried up from below, so the valves can be conveniently regulated from the room in which the moistened air is received. These valves are so adjusted as to allow a constant, but small, flow of steam into their respective air-boxes. This is mingled with the inflowing air as it enters the heating-coil, and is carried with it to the rooms above. The steam is delivered in each box through two ¼-inch pipes, three inches apart. Under these hangs a small pan which catches the water of condensation as it drips from the ends of the steam-pipes. A small overflow-pipe carries off the water from these drip-pans.

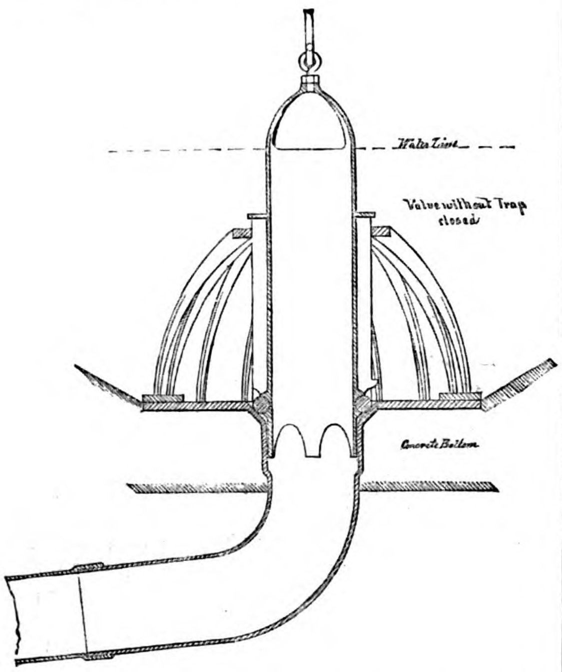
"With this arrangement I easily keep the moisture of my house at fifty to sixty per cent. of saturation during winter. It is easy at any time to increase this percentage, but the result in cold weather is to cause rapid condensation on the windows, which is not desirable. A room

heated to seventy degrees with the humidity at sixty per cent. is far more comfortable than one heated to eighty degrees with the humidity at forty per cent., in my experience, as the former conditions are far more healthful. I am sure that the general adoption of my method of moistening the air in steam-heated houses would be conducive to both health and comfort to all who live in them."

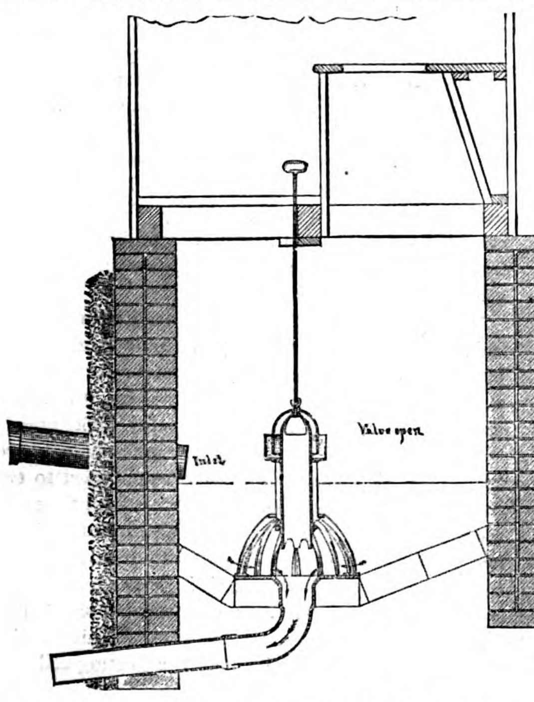
PRIVY-VAULTS FOR TENEMENT-HOUSES.

DR. W. K. NEWTON, Health Officer of Paterson, N. J., in the third report of the Board of Health, illustrates and describes the construction of privy-vaults for tenements as adopted in Paterson, as follows:

"The ordinances require that when a public sewer can be reached all slops, foul water or filth shall be immediately discharged through a proper connection into the sewer; and no privy-vault or cesspool is allowed on lots abutting on sewered streets.



"When proper water-closets, set up in the house and discharged into the soil-pipe, are provided, an efficient and satisfactory means for disposing of filth is present and may be trusted to careful tenants. But the objections to these arrangements are many and are based on economical grounds. They require care; extra water-rent has to be



paid, and, in tenement-houses occupied by ignorant tenants, the cost of keeping them in repair is often great, as all kinds of refuse is thrown into them. For these reasons most landlords refuse or object to placing them in rented houses, and an outside vault is provided in the place.

"As usually constructed, in this city, the outside so-called water-closet is merely a large privy-vault, with a pipe connecting it with the sewer, and no water, for the purpose of flushing or washing into the sewer, is laid on. As a consequence the sewer-connection soon becomes stopped up and the vault is converted into a common privy.

"This evil was so evident that the board has ordained that no such dry vault should be allowed to be connected with the public sewer, but some arrangement must be provided that is thoroughly flushed and from which all filth is washed into the sewer.

"In order that the claim of impossibility or impracticability might not be set up, the mechanical construction of these outside water-closets has been carefully studied, and one has been devised that answers all the requirements of the ordinances, and is not only cheap, but is easily made by any mason or mechanic.

"We may state here that no originality is claimed for this device, for one similar, but not so perfect, has been used for years in New York and Brooklyn, and a picture of these old patterns is given in reports of the New York Board of Health.

"Some twenty-five are now in use in this city, many being put in under the direction of Mr. Houman, the architect. General satisfaction is expressed as to their utility, and the device may be considered a success.

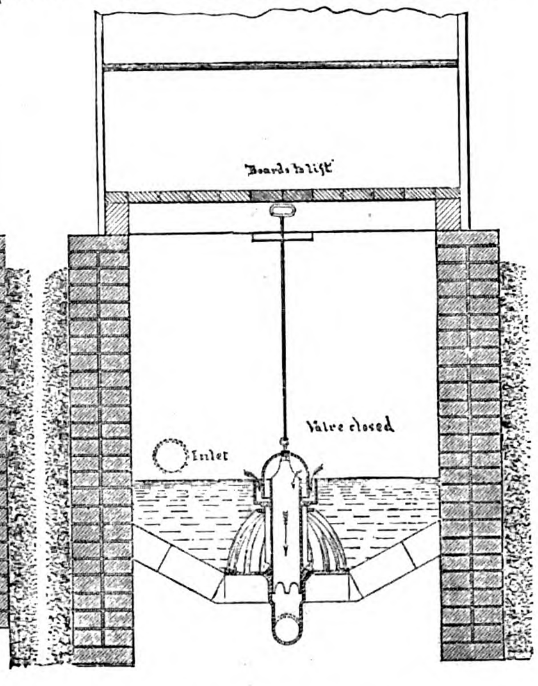
"The illustrations given below will clearly show all points in the construction.

"As the plan for building these water-closet vaults is very simple, a brief description will suffice; further details being obtainable at the office of the Board of Health.

"A vault about four feet deep is constructed of brick, well laid in cement, the sides being eight inches thick. The bottom is made oval, or the shape of the lower half of an egg-shaped sewer, sloping towards the outlet, with a fall of at least one inch to the foot. The bottom should be of concrete covered with brick. In the concrete is firmly imbedded the outlet-pipe, which is connected with the pipe leading to the sewer. A basket of iron is attached to the outlet to keep all large objects out of the sewer-connection. In the outlet-pipe fits a hollow plug about fourteen inches long, which has a rubber gasket at the lower end; this latter makes a water-tight joint with the outlet-pipe, so that all material is retained until the plug is raised, when the water and liquid filth is driven into the sewer with great force, thoroughly flushing the pipe. The plug, being hollow, permits a constant stream of water to overflow into the sewer. At least twelve inches of water is retained in the vault until the plug is raised.

"The iron rod attached to the plug extends through the floor of the outhouse so that it may be lifted as occasion requires.

"All waste-pipes and rain-water leaders may discharge through the inlet-pipes directly into the vault; if this is not done a special water-supply must be introduced.



"The plug may be obtained with a bell-trap on top, but this has no advantage and adds to the cost.

"The interior of the vault should be covered with a coat of hot asphalt, or roofing-tar put on hot, to prevent absorption by the bricks. The wood-work underneath should be painted or covered with tar. The seat should be placed away from the back so that no filth shall strike the wall.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. IX.

(Continued from page 378.)

TANKS.

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

1. What are tanks for?

To contain and furnish water for the supply of fixtures in buildings where external pressure is insufficient.

2. How do you calculate the amount of water a tank will hold? How, if it is a circular-tank?

For square or oblong tank, find area of base by multiplying length and breadth; then multiply by height and reduce to inches; divide by 231, number of inches in U. S. gallon. The product will be number of gallons in tank. For circular tank, find area of base by multiplying one-half circumference by half diameter and proceed as above.

3. Of what are tanks usually made?

Of wood lined with tinned sheet-copper or sheet-lead; also of iron, both cast and rolled. Wood or barrel tanks are frequently used, and slate to some extent.

4. What is the best tank for a house from which water for drinking and cooking is drawn?

A wooden tank lined with sheet-copper. All are unobjectionable, except possibly those lined with lead or zinc, which are prohibited by the Board of Health.

5. Is any precaution necessary in regard to tinned copper?

The soldering should be done with rosin rather than muriatic acid.

6. Why?

Because the acid continues to act on the metal and eventually eats it away.

7. What danger arises from this?

The copper too becomes exposed and renders the danger of poisoning possible.

8. What is meant by flux?

It is a substance used to prevent oxidation and facilitate by fusion the union of metals.

9. What is verdigris?

The rust formed on brass or copper from acids in contact with it. It is very poisonous.

10. How heavy should sheet-lead be in lining a 150-gallon tank?

From 4-lb. to 6-lb. sheet-lead.

11. In small tanks should it be less?

It may be reduced with propriety, but not below 3-lb. sheet-lead.

12. In lining a tank with lead, how is it shaved or soiled?

It is shaved about seven-eighths of an inch from edge of sheet and soiled about six inches wide.

13. What difficulty occurs in an iron tank?

That of rusting.

14. Is there any objection to painting an iron tank?

No. It is advisable, however, not to use lead or zinc paints. Iron-ore paints are good.

15. How are wooden tanks usually made?

Circular generally and of pine or cedar. They are bound with strong iron hoops.

16. Where are these tanks frequently placed?

On the roofs of buildings and should be properly cased and covered on top to exclude frost.

17. Is there any objection to slate tanks?

No. But care should be taken to prevent settling as it is apt to crack the slate.

18. How are iron tanks usually put up?

The plates are usually punched and fitted before bringing to building. They are then riveted if of boiler plate, or put together with nuts and bolts if of cast iron.

19. Are safes advisable?

Always. Except where placed on roofs, when they are unnecessary.

20. Why are they necessary under iron tanks?

To carry off condensation from sides and bottom of tanks.

21. Where should the safe overflow-pipe be carried?

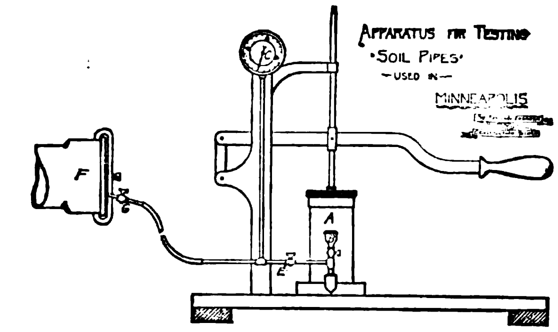
To an open sink, but never into a soil or waste pipe.

(TO BE CONTINUED.)

METHOD OF TESTING PLUMBING IN MINNEAPOLIS.

WE are indebted to Mr. J. M. Hazen, Assistant Plumbing Inspector at Minneapolis, Minn., for a blue print of an apparatus he has designed for testing soil and waste pipes, from which the following illustration is made. Mr. Hazen describes his apparatus and his method of making a test as follows:

To prepare new work for this test, all the iron soil and ventilation pipes must be roughed in, running-trap and fresh-air inlet included. If the water-closets have a trap, then calk in a 4-inch lead bend; otherwise, calk in the lead trap, and solder a piece of heavy sheet-lead over the top. Wipe on the trap ventilation and connect with vent-pipes. Calk in ferrules in all openings for waste or ventilation, with a short piece of lead pipe wiped on. Pinch these ends



and solder them. If the ventilation connects with stack before reaching the roof, then you only have to close the bottom and top of stack, put the proving apparatus on the fresh-air inlet, and apply the test.

Thus we have the whole system of plumbing under test at the same time. Whereas, if only the soil-pipe were tested, there are yet three joints to make for every fixture, which will never be under proper test. Instead of a short piece of lead waste or vent-pipe being calked in, I would, if circumstances would admit, connect up the entire waste with trap attached, take out the crown-vent and connect it with main ventilation-pipe. Then, if the work stands a pressure of ten pounds to the square inch, and holds up to that, it is absolutely tight beyond question, for all fixtures that go on are outside of the traps, now under test.

I consider ten pounds air-pressure ample test for ordinary plumbing. If the work stands at that pressure, it will, as a rule, stand fifteen or more.

I was told at first that cast-iron soil-pipe could not be calked with lead and oakum, to stand an air-pressure of ten pounds, but that theory has vanished, and good workmen have no trouble in making their work as tight as a glass bottle. The greatest danger is in calking around brass ferrules, and great care should be taken lest they "buckle in."

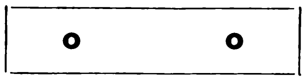
To test a job of plumbing with the proving-apparatus, in the absence of a ⅜-nipple to connect the rubber hose to, it is necessary to have a 2 or 4 inch iron plug with rubber gasket to fit on the shoulder of the pipe in the hub "F," held in place by a clamp over the end of the hub, with a set-screw in the centre to screw down on the plug. Into one side of this plug, screw in a short nipple and cock "G." To attach a hose from the pump close cock "D" and open cock E. Work the pump until the gauge C shows five pounds pressure, then close cock E. If the work is absolutely tight, the indicator will remain at five pounds; if defective the indicator will go down. Now unscrew cap of ether cup B; open cock D and let the pressure off from the pipe; close cock D; put one ounce of ether in the cup; screw on cap; open cock D, to let the ether down, and at the same time begin to work the pump; close cock D; pump up to five pounds pressure, and close cock E. The ether will indicate where the leaks are, which the plumber will at once calk tight. Test the work again at ten pounds pressure, and if the indicator stands at that the work is absolutely tight.

To test the pump, put on ten pounds pressure, close cocks G and E, and if the indicator stands the pump is tight. A little soap and water put on the leaky joints with a brush will show the exact location of a leak by the formation of bubbles. Plumbers, architects, and builders here are perfectly satisfied with its ability to make a thorough test. That, together with its simplicity, commends it at once.

OUTLETS AND INLETS OF WATER-BACKS.

BLOOMFIELD, N. J., March 8, 1887.

SIR: Will you please give me your opinion by letter in regard to the arrangement of a water-back? Do you think a water-back will work satisfactory when both pipes are on a level as the following cut:



Should not one be lower than the other; the lower for entrance of cold water and the higher one for the hot discharge into boiler? Do you think the water-back in the above cut will discharge enough hot water to heat a forty-five gallon boiler? By answering the above you will greatly oblige a subscriber. Very respectfully, JOHN H. TAYLOR.

[The flow-pipe or outlet from a water-back to a boiler should be as close to the top of the back as possible. It would be an improvement even to the flow of water if it could be made practicable to be placed on the top. It is better also to have the return-pipe enter the back as low down as possible, as the greater the vertical distance between the inlet and outlet the better the flow will be.

On page 266 of our issue of February 12, "W. A. P." points out a cause of failure of water-backs by the pipe not leaving near the top of the back.

It is probable, though, that the back shown will be ample for a 45-gallon boiler, and that it will work well enough as it is on its flat, as much air cannot find lodgment within it above the outlet.]

PAINTING IRON SOIL-PIPES AS A PROTECTION AGAINST RUST.

CHICAGO, ILL.

SIR: I have been told that the best way to protect cast-iron soil-pipes is to paint them inside and out with red lead, after testing them with linseed oil to see if there are any sand-holes. It is stated that this is better than to tar them, as the tar in time becomes separated from the pipe. Do you think there is anything in this idea? I would be very glad to get your opinion or that of any of your readers as to their experience with tarred pipe or pipe treated in this manner. SUPERINTENDENT.

[Paint or tar is little or no protection for the inside. Experience has shown that urine and other acids make short work of these substances on the inside of cast-iron pipe. For the outside it is immaterial except as to looks, since the back or wall-side of the pipe cannot receive the annual coat necessary in damp places to prevent slight rust.]

HOT-WATER CIRCULATION.

QUINCY, MASS., March 14, 1887.

IN THE SANITARY ENGINEER AND CONSTRUCTION RECORD, January 18, 1887, page 165, I noticed a communication from "J. S. J.," Troy, N. Y. I would like to know if the circulation would be better if he should return his hot-water pipe to the bath-tub above, instead of below the cold-water supply. A. F. B.

[It would make no difference. Our correspondent is referred to additional comments on this case on pages 188, January 20, and 239, February 5.]

WHO MAKES STEAM HOSE?

LAFAYETTE, IND., February 15, 1887.

WILL you please inform me, through your valuable paper or otherwise, whether there is a rubber hose, or any other kind of a flexible pipe, made that may be used for conveying steam at from 40 to 150 pounds pressure? I want something for making flexible connections that will not rot or crack. If there is, who is the manufacturer?

Yours respectfully, I. E. J.

[The leading rubber manufacturers make steam hose for such a purpose. We believe it will last about a year.]

THE PRESERVATION OF FIRE-HOSE.

68 DEVONSHIRE STREET, ROOM 19, BOSTON, MASS., March 8, 1887.

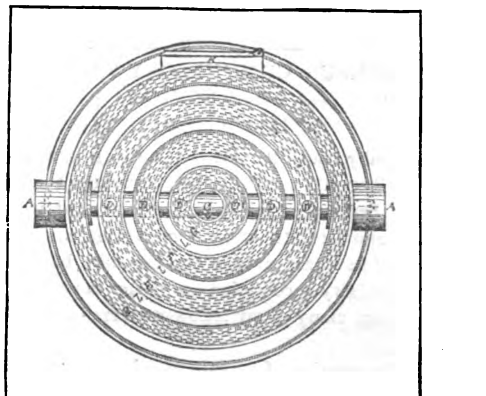
SIR: At our annual town meeting yesterday there arose quite a discussion over the matter of proper method of draining fire-hose in our town. The hose is now kept in the basement of the Town Hall, which is well lighted by windows and also well ventilated. The question came up of an addition of a tower for the purpose of drying and airing the hose, and I wish to ask of you if, in your judgment, a tower would be necessary for the purpose of drying and preserving hose, whether or not they are just as well to be kept where they now are, in the basement, or whether the keeping of them in a tower would really be beneficial and cause the hose to last a very much longer time. You will please keep in mind that the hose are only used (say) twelve times a year or so. It is claimed by some that the hose would last very near as long again if it were hung up in a tower instead of being kept in basement. The hose is woven cotton and rubber hose, such as are used for fire purposes. Yours, C. T. DERRY.

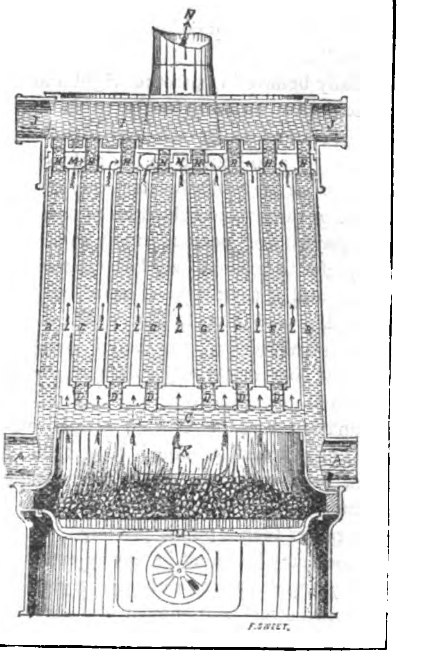
[The New York Fire Department use towers altogether for drying their hose, and they consider an engine-house incomplete without one. They have rods, on which are hung hooks, which take hold of the hose in lengths of fifty feet, and about four feet from the floor. There is perfect ventilation in each case, so that there is air always circulating through the hose. Another method, which is used by the Brooklyn Fire Department, is to lay the hose in lengths of fifty feet along the side of the wall on a shelf or bracket with a small inclination, so as to have air circulating constantly through the hose. Of course, the first method is the best, but it is more expensive than the one used by the Brooklyn Fire Department. Hose kept in a basement will not last as long as if properly dried and ventilated.]

Novelties.

HOT-WATER BOILER.

THE accompanying sectional elevation and plan show a novel hot-water boiler for residence or green-house heating lately invented and patented by Mr. W. E. Nolan, of 170 Eckford Street, Brooklyn, E. D., New York. It is made of cast-iron throughout, and is joined with rust in the manner usual to many cast-iron boilers for this purpose. It consists of a number of annular hollow castings arranged concentrically in a vertical position. The outer annulus B is longer than the rest, and forms a "water-leg," which incloses the fire-pot. From side to side of the furnace a pipe C extends, as shown, upon which the remaining





annular chambers are nippled. A water-dome I caps the whole of another series of nipples connecting it with the annular elements heretofore mentioned, the upper ends of the nipples being "rusted" in. A cover is then placed on the dome and bolted, completing the boiler. From the dome two flow-pipes, J and J, are taken, and two return flow-pipes enter at A and A in the "water-leg."

The annular spaces L and L between the concentric water-rings form the flue-passages and heating-surface, which connect with the space M below the dome and thence with the smoke-pipe N.

In small sizes the centre annulus G is made solid, and when it is desirable to make a magazine-boiler of it it is removed, an opening is provided through the dome, and a tube-magazine is lowered through.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

ASSOCIATION OF OHIO ARCHITECTS.

CLEVELAND, O., March 11, 1887.

SIR: You may suppose when you know the purport of the enclosed resolution that the authors are desirous of achieving glory in the fields of journalism by opening an office for the diffusion of advice to those of the editorial profession whom they judge to be unable to manage their own business. But, no, sir! They merely labor with the desire to bind and preserve your interesting and useful journal without incorporating among their books a vast amount of advertising. Very respectfully, yours,

F. A. COBURN, Sec. A. O. A.

The following is the resolution as passed at the last meeting of the Association of Ohio Architects:

"*Resolved*, That the editor of THE SANITARY ENGINEER AND CONSTRUCTION RECORD be requested to number his journal without including the advertising pages."

[We are glad at any time to receive suggestions from our subscribers, and whenever practicable we try to act on them. For the information of the members of the Ohio Association of Architects, we would say, however, that we know of no reason why any subscriber should bind up our advertising pages if he does not wish to, as our indices furnished at the conclusion of each volume only refer to pages containing reading-matter. Some readers, however, prefer to retain the advertising pages, as they are valuable directory of the building and engineering trades. At the begining of another volume we shall consider this request in all its phases, with a view to doing what may be practicable in the premises.]

PUBLIC VERSUS COMPULSORY VACCINATION —A CORRECTION.

NEW HAVEN, CONN., March 14, 1887.

SIR: I usually read THE SANITARY ENGINEER AND CONSTRUCTION RECORD carefully, but somehow I missed the number for September 23 last, and it has but just come to my eye; and I ask to make a correction and explanation of one of its items, even at this late date, because it relates to compulsory vaccination—a matter in which I differ in opinion from many of my fellow-workers in official sanitation.

In a kindly mention of a paper of mine on "*The Right and Expediency of Public Vaccination*," you say of it, "he makes clear the right, but questions the expediency of public vaccination," etc.

I emphatically believe in both the right and expediency of public vaccination, meaning by that term vaccination at the public expense and under the control and direction of public officials. I also believe in the right of *compulsory* vaccination, but strongly doubt its expediency except in times of active or threatened epidemics of small-pox.

The great majority of persons in any community of our older States prefer to be (and will be) vaccinated by their own physicians and at their own expense, without official interference. If, in addition to this, public vaccination is systematically provided for, my belief is that so large a proportion of the community will voluntarily be vaccinated that serious small-pox epidemics will be avoided and compulsory vaccination need be resorted to only on vary rare occasions. The practical trouble is to get the means appropriated for even voluntary public vaccination, and the difficulty is enormously increased if it be made a compulsory measure rather than a public privilege.

A few persons may be found in nearly every community opposed to any improvement or change, trying to swim up stream, or at least struggling against the current of progress. If these persons have to swim alone it is a hopeless struggle, and they are inevitably carried along by the irresistible current. But give them a little help, and it is curious how, by combined aid, progress may be resisted. Some of these unfortunates oppose vaccination, and, like hose few educated people who deny that the earth is round, or who still hold that the sun moves around the earth, they are beyond argument or reason. I think we all know such men. Where vaccination is voluntary, such persons have no private grievance in the matter; the public will not allow that there is any principle involved; there is no private right invaded; their opposition is looked upon as a whim not very dangerous to the public; they are not seriously listened to and draw but a small following.

If, however, vaccination is made compulsory by law, and when there is no case of small-pox in the town or even in the State, and when the people are not especially stirred up by either immediate or obvious danger, if vaccination is then enforced by law and either violently performed by public officials or those resisting it fined or imprisoned, then the opposers have a personal and pet grievance. A political principle is at stake; they claim that their personal liberties are unwarrantably interfered with; their personal rights invaded; there is something to make a noise about—something to resist—and the resistance is lifted from the insignificant place of a personal whim or private grievance into the dignity of a public wrong. All of this invariably gets a hearing and attracts followers. Great Britain and Canada furnish us with most instructive examples, with their anti-vaccination societies and processions, and public demonstrations, and small-pox epidemics.

There was once an anti-vaccination society started in this State. It printed circulars with a startling picture of a sick and afflicted calf, supplying vaccine; it held public but very small meetings; it tried to make "demonstrations" and be talked about like its English brethren, and to get a newspaper hearing as men working for the rights of their race. But there was too little to make a noise about for the huge public to care about listening. The whole thing was less than weak—it was simply ridiculous, and when its president and chief member died of the small-pox a few years ago, the society probably died also, at least I have heard nothing of it since. The poor thing died of neglect.

Meanwhile, out of a total mortality in this State of 82,105 persons in the last seven years of registration, there have been but sixty deaths from small-pox (thirty-one of them in one year), and there has not been a single death in the last two registration years. Our great need is not *compulsory* vaccination, but money for voluntary vaccination.

Public and official sanitarians have such a big work to do, there are so many directions in which the value of their work is not questioned and where the results are so obvious, there is so much hard fighting that must of necessity be done, there are so many ways in which there must be official interference in the interests of the public health, that when there is no immediate or visible danger from small-pox it seems to me a great pity for health boards to waste their time and energy in compelling a few cranks to be vaccinated against their will. Better for the community for us to expend our sanitary work where it will do more good. Let them go; if they catch the small-pox, let us quarantine them; if they die, let us console ourselves with the thought that it is one of Nature's ways of arguing with fools; let us drop a respectful tear to their memory, have them safely buried, and disinfect their premises for occupation by a generation having more sense. Yours respectfully,

WILLIAM H. BREWER.

HOW TO MAKE BRICK FLOORS OF STALLS FOR HORSES IMPERVIOUS TO LIQUIDS.

NEW YORK, March 15, 1887.

SIR: A communication from "Architect" in THE SANITARY ENGINEER AND CONSTRUCTION RECORD of the 12th inst. requests information regarding a non-absorbent material for stalls and floors in stables. The compressed asphalt blocks of the Hastings Pavement Co., Hastings-on-Hudson, N. Y., are precisely adapted to this use. They are absolutely non-absorbent; and, when laid with grouted or pitched joints, form a perfectly water-tight, non slippery floor, which with daily washing is entirely free from the odors inevitable in all stables floored with absorbent material.

C.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
March 12........	25.31	20.19	20.75	30.52	28.31	25.00	31.56

E. G. LOVE, Ph.D., *Gas Examiner*.

THE Yonkers, N. Y., Municipal and Westchester Gas Companies have consolidated and will raise the price of gas after April 1 from $1.25 to $1.75 per 1,000 cubic feet.

THE following facts concerning the Baku petroleum supply have been abstracted from the *Chemiker Zeitung* by the *Journal of the Society of Chemical Industry*. Although large quantities of petroleum are still obtained from the Baku region, it appears nevertheless that the yield is steadily decreasing, and that in four or five years it will hardly suffice to supply the Russian demand alone. Borings are now made to depths of 100 to 150 fathoms, where formerly the oil was reached at 40 to 45 fathoms. In some cases borings right through the oil-containing strata on to the underlying volcanic rocks (300 fathoms) have failed to produce oil. Boring is nevertheless continued, although the price of oil, owing to the market being overstocked, is practically nothing. The price for crude naphtha on the spot is less than a half-penny per gallon, and for petroleum and kerosene of the best quality twopence per gallon. The opening up of new localities for boring is contemplated, and the whole district between the greater and lesser Caucasus is believed to contain oil-yielding strata. The value of the Baku products could be considerably enhanced were capital and chemical knowledge at hand to effect improvements in the processes employed.

ENGINEERS' CLUB OF KANSAS CITY.

OUR correspondent writes under date of March 8: "A new engineering society has been recently formed with thirty-five charter members under the title of "The Engineers' Club of Kansas City." Monday evening they held their first formal meeting in their club room, No. 19 Deardorff Building, Kansas City.

"A paper on 'Sewer-Gas' was read by E. B. Kay, C. E. member of the club, treating at length of its constituents, its physical properties, its effect on the health, and the means in use for its detection and prevention.

"The paper was well discussed after being read by those present, and it was voted to have it printed.

"The interest shown at this meeting speaks well for the future of the club."

THE Toronto Architectural Draughtsmen's Association met March 8, and heard a paper on "Arches in Architecture," by Mr. W. L. Symons.

CLEVELAND, O., ENGINEERS' CLUB.

THE annual meeting of the club was held March 8. Reports of the various committees were received, and the following officers were elected:

President, John Whitelaw; Vice-President, W. R. Warner; Corresponding Secretary, C. O. Arey; Recording Secretary, C. M. Barber; Treasurer, S. J. Baker; Member of the Board of Managers of the Association of Engineering Societies, M. E. Rawson.

The Committee on National Public Works reported that a meeting of civil engineers would be called during the summer at Washington, to take measures to influence legislation in the next Congress.

CAPTAIN JAMES B. EADS, whose death at Nassau, N. P., was noticed last week, was born at Lawrenceburg, Indiana, in 1820. As a lad he was not trained for the professsion of engineering, but his strong natural bent led him to educate himself in that direction. Before the Rebellion he made a fortune by his connection with a wrecking company, and during the war gained a reputation as a man of resource by the speedy creation of a fleet of gunboats on the Mississippi River. Since 1865 he became famous as the engineer of the steel railway bridge over the Mississippi River at St. Louis, and especially by the Jetties system of improving navigation on the lower Mississippi. At his death he was urging upon Congress the guarantee of his ship-railway project across the Isthmus of Tehuantepec. A bill relating to his scheme passed at the last session of the U. S. Senate, but was killed in the House Committee room.

MR. WILLIAM D. FORBES, of Bridgeport, Conn., contributes an interesting article to *Engineering*, of London, on the manufacture of pipe-fittings in the United States. He reviews the practice of the past thirty years, from the time fittings were made of brass and the screw-threads were chased by hand in an ordinary brass-finisher's lathe, to the present time when ingenious machinery turns out in vast quantities fittings from ¼-inch to 12 inches. The article contains numerous illustrations, showing the development in tapping machinery, concluding with data regarding the adoption of a standard thread in the United States, with which the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD are familiar.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE feature of the second meeting in the month of the American Society of Civil Engineers at their rooms in this city was a paper by Mr. Tompkins, associate of the society, giving a detailed account of the brick industry in vicinity of New York, followed by a discussion. An account of the character of the bridge on the Boston and Providence Railroad that recently fell with such fatal results was also given by Mr. A. M. Wellington, Editor of the *Engineering News*. Mr. Wellington introduced Mr. Henry S. Pritchard, of Philadelphia, who had made an investigation in behalf of the *Engineering News*. He brought back and exhibited a couple of broken eye-bars which showed an old fracture besides original bad construction. These eye-bars were evidently the same as those referred to by our correspondent elsewhere in this issue. Mr. Pritchard was of the opinion that the accident was due to the weakness of the bridge and that no previous derailment of the cars had taken place. The unexplained circumstance was the fact that the bridge had not fallen before, especially when its character and plan of construction was described.

THE NEW YORK ARCHITECTURAL LEAGUE.

THE quarterly meeting and exhibition of drawings of the New York Architectural League was held at Morelli's Restaurant, Monday evening, March 7. The attendance was large and important matters were discussed.

The Secretary reported the progress of communications relative to the opening of the Metropolitan Museum of Art on Sundays.

The Committee on Current Work reported, through Mr. Wright, that they hoped to continue the exhibits of sketches and drawings, and stated that at the next meeting there would be an exhibition of sketches made by Mr. C. A. Rich.

The Committee on Admissions presented the following names for membership in the League: Fred S. Lamb, Charles M. Shean, A. Page Brown, T. A. Koen, James H. Taft, Willard P. Little, Charles M. Clinton, and Oliver Herford, of New York City, and Edward B. Green, of Buffalo. The gentlemen were all elected.

A committee of five was appointed to revise the constitution and the meeting adjourned. The walls were covered, with sketches, and nearly every member was represented.

BOSTON SOCIETY OF CIVIL ENGINEERS.

THE annual meeting of the Boston Society of Civil Engineers was held March 16, in the parlors of Young's Hotel. The meeting was called to order at 4:40 o'clock, President George L. Vose in the chair.

After the reading of the annual report of the government, the following officers of the society were elected for the year 1887-8: President, L. F. Rice; Vice-President, F. P. Stearns; Secretary, H. L. Eaton; Treasurer, Henry Manley; Auditor, Thomas Aspinwall; Librarian, H. D. Woods.

At 6:15 o'clock the meeting was adjourned to the dining-hall, where the members sat down to the annual dinner. The following were present as guests of the society: Major W. P. Shinn, Vice-President N. Y. & N. E. R.R.; Samuel M. Gray, City Engineer of Providence; Dr. Robert N. Greenleaf, of Boston.

PERSONAL.

LIEUTENANT F. P. GILMORE, U. S. N., has been ordered to duty as inspector of steel for the new cruisers.

NAVAL CONSTRUCTOR L. F. FERNALD, U. S. N., has been detailed to superintend the construction of the cruiser "Charleston," which is to be built in San Francisco.

MR. EDWARD H. BROWN has resigned from the offices of Secretary and Treasurer of the Syracuse, N. Y., Water Company and accepted the office of Vice-President of the Nevada County Narrow-Gauge Railroad Company, of California, with headquarters at Grass Valley, Cal.

MAYOR-ELECT EDWIN H. FITLER, of Philadelphia, has announced that General Louis Wagner will be Director of Public Works, and Ex-Mayor Stokely will be Director of Public Safety under his administration.

MR. W. BELL DAWSON has been appointed by the Board of Works of Toronto Assistant City Engineer.

MAYOR SMITH, of St. Paul, Minn., has appointed the following to be members of the New Board of Public Works: John C. Quimby, Richard L. Gorman, William Barrett, and Edward C. Starkey.

SANITARY EXAMINATIONS OF AIR, WATER, AND FOOD. A *vade mecum* for the Medical Officer of Health. By Cornelius B. Fox. Second Ed. 563 pp., 8vo. Philadelphia: P. Blakiston, Son & Co. 1887.

In his introductory observations, Dr. Fox says that his "ideal of a Medical Officer of Health is that of a physician who is thoroughly conversant with every question affecting public health, and who is able to analyze quantitatively water, air, and food, and is so well versed in analytical work as to be able to take his oath in a court of justice respecting any matter requiring the assistance of a scientific expert in State medicine." This is clearly an ideal which is rarely realized in this country, but it is one to be sought for. The work before us is one that is well known to analytical chemists and to many health officers as a very convenient manual for consultation on the subjects of which it treats, but its usefulness will be to a considerable extent in proportion to the amount of practical laboratory instruction which has been obtained by the man who uses it.

The sections on biological methods of air and water analysis are not up to date, but these methods require a treatise to themselves, and such a treatise could only be written by one who has done much work in that field. Dr. Fox's book is one that should be in the library of every health officer and of every analytical chemist.

ST. PAUL, MINN., BOARD OF HEALTH.

A BILL has passed both houses of the Legislature providing for the reorganization of the St. Paul Board of Health. The bill creates a public health department to consist of a commissioner, the chief of police, corporation attorney, and the assistant commissioner. The principal provision of the bill relates to the office of health commissioner, which is created with a salary of $2,500 per annum. The commissioner must be a competent physician and is to be appointed by the Mayor. His term of office is four years, commencing on the second Monday in March next. A $3,000 bond is required. The commissioner is authorized to appoint an assistant commissioner at a salary of $1,500, seven health officers at $840 each, two meat and one live stock inspectors at $840 each, two watchmen, one for day and one for day and night dump at $500 each, all to be under the direction of the commissioner. Should necessity arise for more health officers or inspectors at any time or other employees the commission shall have power to appoint them with the consent of the council. The commission shall have power to remove any of these officers. The duties of the commission shall be the enforcement of the laws relating to the sanitary condition of the city and shall give to the Mayor and other city officers any professional advice they may desire with a view to the preservation of the public health. The commission is given power to quarantine by proclamation any vessel or railroad-car containing persons with contagious diseases, and to station physicians at such quarantine places, at a salary of not less than $5 or more than $10 per day.

DURING the month of November 166 deaths from, and 407 cases of diphtheria were reported in New York City. While the majority of these occurred among the tenement-house population, whose habits are such that a single case of the disease, unless promptly removed to the hospital, almost inevitably becomes a centre of contagion, an instance of the neglect of isolation and proper precautions is given in the *Herald* of December 4, in the family of Dr. Clausnitzer, where successive cases of the disease in malignant form occurred; yet the doctor continued to practice, and no effort to protect the public seems to have been made until the doctor himself was attacked. Some of these children were pupils of one of the public schools, but this school received no notice of the danger. Of course there was neglect and inefficiency on the part of some official or officials of the Health Department to produce such a state of things, for the laws and regulations are ample to provide for proper precautions in this class of cases. Probably this diphtheria outbreak will have a good effect in stimulating sanitary work in some of the tenement-houses, and if this is the case it is not an unmixed evil.

THE thirteenth annual report of the Secretary of the State Board of Health of Michigan for the year ending September 30, 1885, contains the account of the proceedings of the board for the year, with statistical supplements, in continuation of the records contained in previous reports, relating to meteorological conditions and to the times of greatest prevalence of certain forms of disease.

The most interesting paper is that prepared by the Secretary, Dr. Henry B. Baker, with regard to communicable diseases in the State during the year 1885, and especially that part of it which relates to diphtheria. Of this disease there were reported during the year 467 outbreaks in 396 localities, giving rise to 4,018 cases and causing 964 deaths. The mortality was high, being 24 per cent. of the cases. In 285 cases occurring in children from one to five years of age the death rate was 40 per cent., and in 459 cases in children from five to ten years of age the death-rate was 29 per cent. The main cause of the disease was contagion, and Dr. Baker is evidently skeptical as to the possibility of its spontaneous origin, in which we think he is quite right. He thinks it probable that the contagion of diphtheria has in some cases a very persistent vitality, that it may retain its power for months and even for two or three years, and some of the reports which he quotes seem to justify this opinion.

These reports also show that diphtheria is a preventable disease, and that isolation and disinfection will soon put an end to its spread in any locality.

Scarlet fever was decidedly less fatal than diphtheria, for in 2,750 cases of the former disease there were but 187 deaths, or about 7 per cent. Of typhoid fever they were reported 715 cases and 194 deaths.

The whole of this paper of Dr. Baker's is worthy of careful study by all who are interested in practical sanitation.

IN the fifteenth annual report of the Board of Health of the city of Boston for the year 1886, the number of deaths reported in the city during the year was 9,268, while for the previous year it was 9,618, showing a lessened death-rate. As the population is not precisely known, the actual death-rate is uncertain; but taking the population at 400,000, the mortality would be 23.17 per 1,000. The mortality from zymotic diseases was low, as was also that among children, and the whole record indicates that progress has been made in sanitary improvement.

The number of cases of contagious diseases reported to the Board of Health during the year was 3,935, against 5,386 in 1855; 1,537 privy-vaults were abolished during the year, which is substantial progress.

In the remarks on street-cleaning the use of salt to remove snow and ice is rather strongly condemned, apparently in ignorance of the fact that this matter has been several times investigated, both in this country and Europe, and always with the conclusion that the use of salt under such circumstances has no injurious effect upon either men or horses. The recommendations in regard to street pavement is a rather surprising one as coming from the Boston Board of Health. It seems to us that the Board should have investigated this matter for itself, or else have refrained from comment. The house-to-house inspections, the result of which, as stated in previous reports, were always interesting, seem to have been discontinued.

THE Louisville, Ky., Medical Society has appointed a committee of five to arrange for a sanitary convention in Louisville.

CHATTANOOGA, TENN., has an ordinance regulating plumbing-work.

Patents.

357,572. Electric Heater. W. Leigh Burton, Richmond, Va. Filed April 23, 1886. Serial No. 199,880. Issued February 15, 1887.

357,589. Speaking-Tube. Allen S. Fontaine, New York. Filed October 22, 1885. Serial No. 180,588. Issued February 15, 1887.

357,592. Soda-Motor. Arnold J. Grafenstatt and William Tweedie, Minneapolis, Minn. Filed November 2, 1886. Serial No. 217,774. Issued February 15, 1887.

357,603. Hose or Pipe-Coupling. Robert E. Ismond, Chicago, Ill. Filed August 7, 1886. Serial No. 210,298. Issued February 15, 1887.

357,624. Pipe-Coupling. William Piel, Allegheny, Pa. Filed September 23, 1886. Serial No. 214,374. Issued February 15, 1887.

357,637. Rock or Coal-Drill. Jakob Sheib, Rapid City, Ill. Filed June 10, 1886. Serial No. 204,709. Issued February 15, 1887.

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

AMONG THE ARCHITECTS.

THE following are some of the principal buildings which the New York architects have in hand to be erected outside of this city :

Montreal, Canada.—Depot for the Canadian Pacific Railroad Dimensions 400x200 feet ; exterior of local stone, with a tile roof ; massive and Romanesque in style ; Bruce Price, architect.

Sandon, Canada.—Depot and Sheds for the Canadian Pacific Railroad. Dimensions, 40x80 feet ; exterior of stone and brick.

Boston and Albany Railroad.—Several new parlor-cars of the bay-window pattern ; constructed of mahogany, with rich byzantine decorations ; Bruce Price, architect.

Flushing, N. Y.—Village Hospital. Dimensions 104x51 feet ; exterior of panel-work, half timber, with a shingled roof ; interior of white pine, oiled and stained ; the building is of the old English style.

San Mateo, Cal.—Residence for W. H. Howard, of San Mateo ; dimensions, 90x50 ; frame and stone building, and exterior of red wood ; Bruce Price, architect.

San Mateo, Cal.—Residence for S. W. Sharon, of San Mateo ; dimensions, 150x50 ; English baronial style ; interior finishings of hard wood ; Bruce Price, architect.

Mount Auburn, Cincinnati, O.—Residence for Frederick Colston, of Cincinnati ; dimensions, 40x60 ; plain brick and shingles; Bruce Price, architect.

Vancouver, B. C.—Block of store buildings for the Earl of Durham ; exterior of brick; plain interior ; Bruce Price, architect.

Colorado Springs, Col. — Residence for Bruce Price ; dimensions, 30x60 ; seventeenth century French style ; interior finishings of hard wood ; exterior, shingles and frame; Bruce Price, architect.

Banf Park, Alberta Province, B. C.—Hotel and Sanitarium Building to cover one and a half acres of ground ; exterior of shingles, and entirely surrounded by porches ; for the Canadian Pacific Railroad Company ; Bruce Price, architect.

Monmouth Beach, N. J.—Frame stable for Mr. George Sheldon, of New York ; dimensions, 40x22; colonial style; exterior of wood and shingles; Lamb & Rich, architects.

Monmouth Beach, N. J.—Frame stable for Mr. Prentice, of New York; dimensions, 50x29; colonial style; exterior of wood and shingles; Lamb & Rich, architects.

Upper Montclair, N. J.—Frame dwelling for Mr. Heustice, of New York; colonial style, two-story and attic; dimensions, 40x60; exterior of first story of stone, remainder of cypress shingles; interior finishings of hard wood; cost, $12,000; George W. Da Cunha, architect.

Bergen Heights, Jersey City.—Queen Anne cottage for Mr. Thomas H. Williams, of Jersey City; dimensions, 47x54; exterior of redwood shingles and interior finishings of hard wood; Charles Smith, architect.

Plainfield, N. J.—Club building for the Plainfield Sangerbund Society; dimensions, 45x80; exterior of brick and terra-cotta; interior finishings of plain white pine.

NEW YORK CITY.

192 Delancey st 5-story and basement Philadelphia br ten; cost $22,000; o, Zubrinski & Gootman, 25 E Broadway; a, F Ebeling.

30 Pike st, 5-story Philadelphia br ten; cost, $19,000; o, Louis Gootman, 165 Henry st; a, Fred Ebeling.

144 W 10th st, 5-story br and brown stone apt house; cost, $18,000; o, Charles Guentzer, 22 E 3d st; a, William Graul.

163-165 W 13th st, 2 4-story Philadelphia br dwells; cost, $22,000 all; o, H F & W G Howenstine; a, Charles Rentz.

22d st, s s 81 E 8th av, 4-story br store and ten; cost, $6,000; o, J F Neher, 234 8th ave; a, Marshall & Walter; b, not selected.

309 E 43d st, 2 5-story br factories and boiler-house; cost, $14,000 each; o, Charles Graham & Sons, 305-309 E 43d st.

333 E 61st st, 3-story br rectory; cost, $24,000; o, Andrew Ziegler; a, Henry Bruns.

BUILDING INTELLIGENCE.
NEW YORK CITY.—Continued.

82d st, n s, and s s 83d st, 80.6 w Av A, 2 (one on each st) 5-story br tens; cost, $24,000 each; o, a, and c, J C Burne.

102d st, s s, 300 w 2d av, 2 4-story br tens; cost, $15,000; o, Henry Hawkes, 125 Washington st, Brooklyn; a, J C Burne; c, day's work.

113th st, n w cor 4th av, 5-story br ten; cost, $30,000; o, J S Scott, 60 E 113th st; a, J C Burne; c, day's work.

113th st, n s, 25 w 4th av, 4 5-story br stone ten; cost, $21,000 each; o, J S Scott; a, J C Burne; c, day's work.

116th st, n s, 595 e Av A, 3-story Russian bath; cost, $17,000; o, William G Tucker, 451 E 119th st; a, Charles Baxter.

85th st, s s, 100 w 9th av, 10 4-story and basement br and br stone dwells; cost, $14,000 each; o, a, and b, I M Grenell, 1483 9th av.

91st st, n s 80 e 9th av, 2 5-story br and sandstone tens; cost, one $20,000 the other $15,000; o, Charles McDonald; a, H L Harris; b, not selected.

146th st, s s, 75 w 10th av, 4-story br ten; cost, $18,000; o, a, and b, William Fernschild & Son.

7th av, e s, 24.11 s 130th st, 4 5-story br tens; cost, $12,500 each; o, R C Dorsett, 2120 6th av; a, C P H Gilbert; b, not selected.

138th st, s s, 450 w Willis av, 42 3-story and basement stone and br dwells; cost, $12,000 each; o, J C Bushfield, 166 Decatur st, Brooklyn; supt Charles Baxter.

S e cor 8th av and 116th st, br elevator tower; cost, $30,000; o, Central Park Improvement; a, Charles H. Kendall.

W s Madison av, 62 ft n of 80th st, br flat and store; cost, $40,000; o, Edmund Dodge; a, Marshall & Walker.

242-244 W 28th st, factory; cost, $50,000; o, M Groh Sons; a, Lederle & Co.

N e cor First av and 60th st, flat and store; cost, $22,000; o, John Flynn; a, F T Camp.

E s of First av, 25 ft n of 60th st, 2 flats and stores cost, $36,000 all; o, John Flynn; a F T Camp.

239 W 125th st, store; cost, $15,000; o, C L Hanscon; a, Cleverdon & Putzel.

N e cor 10th av and 157th st, flat and store; cost, $22,000; o, Erastus B Treat; a, Charles S Werner.

1424-1426 Broadway, flat and store; cost, $16,000; o, Daniel McElory; a, George W Da Cunha.

E s Second av, 100 ft n of 106th st, flat and store; cost, $18,000; o, James King; a, A B Ogden & Son

N e cor 7th av and 129th st, 6 flats and stores; cost, $118,000 all; o, Homer J Beaudet; a, Richard W Davis.

S w cor 7th av and 133d st, 4 br stores and flats; cost, $82,000 all; o, Homer J Beaudet; a, Richard W Davis.

First av, 60 ft n of 26th st, br public building and hospital; cost, $8,000; o, City of New York; a, N L Breese & Son.

Lorillard st, s e cor and s w cor 188th st, 12 br dwells; cost $51,000 all; o, Henry C Thompson; a, J C Thompson.

N s 156th, 100 e 11th av, 4 stone and fr dwells; cost, $46,000 all; o and a, Wm. M. Grinnell.

70 James, 1 br ten and store; cost, $12,000; o, Mary Sullivan; a, John B. Franklin.

N w cor 82d and West End av, 7 br dwells; cost, $70,000 all; o, McKinley & Grum; a, Lamb & Rich.

787-789 Washington, 2 br flats and stores; cost, $36,000 all; o, Ella A. Treacy; a, Thom & Wilson.

S s 83d, 100 e 2d av, 2 br flats; cost, $30,000 all; o, Lucas George; a, John Brandt.

80th, 30 w Lexington av, 5 br dwells; cost, $70,000 all; o, Breen & Nason; a, Hubert Pirsson & Co.

St. Nicholas av, 284 n 135th, 2 br flats; cost, $36,000 all; o, George B. Gillie; a, Richard R. Davis.

N s 95th, 80 e 9th av, br dwell; cost, $12,000; o, Squire & Whipple; a, Nelson M. Whipple.

20 Beach, br ten and store; cost, $11,000; o, H. McArdle; a, M. C. Merritt.

N e cor 7th av and 134th, 3 br flats and stores; cost, $59,000 all; o, White & Anderson; a, Sniffen & Jenks.

N s 120th, 100 e 6th av, 5 br dwells; cost, $90,000 all; o, James Kilpatrick; a, Alfred Barlow.

BUILDING INTELLIGENCE.
NEW YORK CITY.—Continued.

N s 101st, 74 e Tenth av, br dwell and store; cost, $5,000; o, John Glackner; a, Charles Baxter.

535-539 135th, 3 br tens; cost, $30,000 all; o, Frank E. Smith; a, James G. Bushill.

ALTERATIONS, NEW YORK.

62 W 22d st, 2-story br extension; cost, $7,000; o, John Eylers, 342 6th av; a, Berger & Baylies; c, C W Klappert's Sons.

8 W. 23d, br public bldg, Art Exhibition and Studios; cost, $5,000; o, Cutting Estate; a, H. Elardo Fickien.

145-149 Bowery, 2 br workshops and stores; cost, $8,000 all; o, Hymen Norange; a, Julius Kastner.

286 Hudson, br dwell; cost, $5,500; o, Anthony Voelker; a, Edward Wenz.

BROOKLYN

N Portland av, 242 n of Auburn pl, br blacksmith repair shop; cost, $19,000; o, City of Brooklyn; a, Engineer Bureau.

54 Knickerbocker av, fr dwell and store; cost, $6,000; o, Al Dinkelacker; a, Th Engelhardt.

S s Greene av, 200 e Knickerbocker av, 5 fr dwells; cost, $25,000 all; o, C. Monds & Sons; a, E. G. Golloner.

N w cor 3d av and Dean, fr store and dwell; cost, $13,000; o, Henry Allerman; a, Francis Ryan.

S s N 10th, 125 w Bedford av, 2 br ten; cost, $12,000 all; o, T. F. Siegel; a, N. Herbert.

590 Leonard, br ten; cost, $5,800; o, James Hecker; a, as above.

S e Eastern Parkway and Van Sicklen av, 2 br tens; cost, $9,000 all; o, A Herlich; a, Schrempf & Loeffler.

S s 14th, 72 w 6th av, br double flat; cost, $7,000; o, Thomas Butler; a, William H. Wirth.

W s 6th av, 20 s 14th, 5 br double flats; cost, $35,000 all; o and a, as above.

W s 4th av, 20 n 12th, 3 br double flats; cost, $24,000 all; o and a, as above.

S e cor Union av and Jackson, 2 br stores and dwells; cost, $17,000 all; o, Fred Schneider; a, A. Herbert.

W s Hicks, 50 n Pineapple, 3 br dwells; cost, $24,000 all; o, Charles A. Gilvei; a, Charles Werner.

S s St. Mark's av, 115 e Rodgers, 3 br dwells; cost, $16,800 all; o, W. B. Osgood and H. S. Sadler; a, W. J. Conway.

S e cor 48th st and 3d av, 1 br store and dwell; cost, $6,000; o, Pat Creshard; a, W H Wirth.

W s, N 11th st, 100 e Bedford av, br factory; cost, $6,000; o, Pfeiffer & Laranberg; a, E F Gaylor.

N w cor 5th av and Degraw st, 4 br stores and dwells; total cost, $45,000; o, Dan'l Buckley; a, F Ryan.

N s Bushwick av, 100 e Conway st, 2 brick dwells; total cost, $9,000; o, S & J Cocroft; a, M. J. Morrill.

S s Monroe st, 90 n Sumner av, 3 br dwells; total cost, $15,000; o, Ferguson & Thomas; a, J A Hamilton.

S s Van Buren st, 22 w Patchen av, 3 brick dwells; total cost, $12,000; o, Jas W Stewart; a, Isaac D Reynolds.

36-38 Driggs st, br ten; cost, $20,000; o, Herman Colell; a, Benj Frickensiper.

S w cor 6th av and 12th st, br store and dwell; cost, $7,000; o, Thos Butler; a, W H Wirth.

N s Madison st, 380 e Sumner av, 4 brick dwells; total cost, $15,200; o, W Johnson; a, J W Bailey.

N w cor 4th av and 12th st, br store and flat; cost, $7,000; o, Thos Butler; a, W H Wirth.

N s Madison st, 460 e Sumner av, 8 brick dwells; cost, $32,000; o, W. Johnson; a, J W Bailey.

ALTERATIONS, BROOKLYN

308 Fulton st, br bldg; cost, $9,000; o, E C Wilson; a, J G Glover.

238-244 and 252-258 and 234 Van Brunt st, all br dwells; total cost, $11,200; o, A B Camp.

101 Sands st, br dwell; cost, $7,000; o, Bernard Leavy; a, Aug Pauli.

BUILDING INTELLIGENCE.

ALBION, IND.—Plans for a court house to cost about $80,000 have been completed by Mr. E. O. Fallis, architect, of Toledo, O.

ATHENS, TENN.—A syndicate of capitalists is building on a large scale here.

AUGUSTA, ME.—It is reported that additions will be made to the State House at a cost of $85,000. J. W. Bradbury, of Augusta, can give further information.

ALLEGHENY, PA.—Washington st, 3 story br. bldg ; cost $21,000 ; o, St. Mary's Catholic Church ; a, Henry Moser ; b, C. F. Reif.

Irwin Ave, 1 story bldg, 50 ft. high, cost $20,000 ; o, Panorama Co.; a. Burnham and Root, Chicago; b, Jas. Wherry.

BALTIMORE, MD.—Mosher and John st, 3-story br dwell; o, I H McAfee.

Calvert and Biddle, 3-story br dwell; o, Mrs M S Farber

214 Mount, 3-story br dwell; o, P McLaughlin.

49-51 Lancaster, 2 3-story br dwells; o, Fred Loehr.

Druid Hill ave, 3 3-story br dwells; o, F O Singer.

Hanover and Pratt 2 4-story br warehouses; o, D M Newbold.

Mr Charles L Carson, architect, is preparing drawings for the Darby Building, lately burned. It will be of brick and stone, 8 stories high; supt, Israel Griffith.

BOSTON, MASS.—The Boylston Market Association will rebuild the market.

(Continued on Supplement.)

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 17. PUBLISHED EVERY SATURDAY.

NEW YORK, MARCH 26, 1887.
LONDON, APRIL 9, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA.
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

DEFECTIVE SANITATION AS A CAUSE OF PUERPERAL DISEASE.

UNDER the above title Dr. W. S. Playfair, one of the leading physicians of London, has recently given an address in which he describes several cases of puerperal fever occurring in houses of the best class, and in which investigation showed that the patients had been exposed to the influences of sewer-air during and immediately after labor. This exposure was caused by leaky and defective fittings in the house-plumbing, and in the address, as published in the *Lancet* of February 5, 1887, several diagrams are given, showing the relations of the bedrooms of the sick women to leaky soil-pipes, trapless bath-wastes, etc., etc.

Undoubtedly a woman, immediately after the birth of a child, is specially susceptible to the action of the specific germs which tend to produce inflammation and abscesses, and either soil-pipe or sewer-air is specially liable to contain these germs.

We have had occasion before to comment on the special danger incurred by a woman who is confined in the autumn in a city house of the better class which has been unoccupied during the summer. All such houses are connected with either sewers or cesspools, and unless the traps be kept sealed with fluid, the germs above referred to are liable to enter the bath-rooms, and bedrooms connected with them, and to be found in the dust which settles in various parts of the room. If the house is unoccupied for any length of time the traps will become unsealed by evaporation. This danger can be avoided by filling the traps with glycerine, or by making arrangements to have water run in all all the fixtures for a moment or two once every day.

If through ignorance or forgetfulness these precautions have been omitted, a thorough removal of all dust by cloths or sponges moistened with a solution of bi-chloride of mercury of the strength of 1 to 1,000, with aeration of all rooms, is the best way to obtain security. Special care should be taken not to do any dry sweeping or dusting in the rooms until all surfaces have been rubbed with the solution above referred to, for unless this be done the dangerous dust will be merely whisked about and displaced, but not destroyed.

VITAL STATISTICS IN ENGLAND.

THE annual report of the Registrar-General of births, deaths, and marriages in England for the year 1885 is another of those annual balance-sheets of life and death in England to which sanitary science owes so much, and which increase in value with each succeeding year. Probably to the average reader none of the English blue-books are less attractive than this, made up as it is almost entirely of tables and figures, and yet there are none that have a more interesting story to tell, if one can only appreciate it. It deals with the births, deaths, and marriages of over twenty-seven millions of people, comprising all sorts and conditions of men. Of every 1,000 of these 14.4 were married during the year, the lowest proportion for nearly fifty years.

Why is it that the tendency to wedlock is diminishing in England? As the price of food has also been diminishing, it would seem, as the Registrar-General remarks, that when the standard of living has been raised mere sufficiency of food is no longer felt to be a sufficient justification for marriage.

If we look at the table showing the ages of the bridegrooms in different occupations, we find that in each 1,000 of miners 169 were under 21 years of age, and 535 between 21 and 25, while in each 1,000 of the professional and independent class only 7 were under age, and 144 between 21 and 25. Of farmers and farmers' sons 31 were under age and 253 between 21 and 25. Among miners, factory-hands, laborers, and artisans, the year of life in which the greatest number of marriages takes place is the 22d—that is, as soon as the men become of legal age—while in the professional and independent class the year of life for the greatest number of marriages is the 28th year of life.

The birth-rate for the year was 32.5 per 1,000, the lowest since 1844, when it was 32.4. The illegitimate birth-rate was 1.56 per 1,000 persons living, which is also a decrease. The death-rate was 19 per 1,000, lower than that recorded in any year except 1881, when it was 18.9. This diminution in the death-rate has occurred almost entirely among infants. Of each 1,000 children born during the year, 138 died, the mean proportion for the ten preceding years having been 144. An interesting section of the report is that which analyzes the 939 deaths reported during the last 38 years as due to hydrophobia. This cause of death is much more frequent among children under 15 years of age than among adults, and it is between three and four times more frequent among males than it is among females, the difference being probably due to difference in liability to bites from dogs. The usual interval between the bite and death is between one and two months; the shortest interval was 12 days.

IT is a matter for congratulation that the United States Navy Department has received bids from three responsible companies to furnish the armor-plate and forgings required for the new cruisers authorized by Congress. It is also a matter for congratulation that the lowest bids in the aggregate for the armor-plate and forgings came from the Bethlehem Iron-Works, which has been many years fortunate in having for its superintendent Mr. John Fritz, than whom no engineer in the country stands higher in his special field. Mr. Sayre, manager of that company, in a letter accompanying the bids, showed his appreciation of expert knowledge when he truly said: "It has, what is quite as essential as any other item to insure satisfactory results, a large corps of trained skilled experts, mechanics, and workmen commanded by a chief of well-known and acknowledged ability, accustomed to accomplish what he undertakes."

IF the Boston and Providence Railroad management had shown that appreciation of expert skill in the different engineering departments of their road which it is evident the directors of our large steel-works do, no such worthless bridge as that which failed with such fatal results last week would have been in use, and we may hope that the costly experience the company had with rule-of-thumb practice in engineering will result in the employment of educated engineers having special knowledge of the departments of railroad engineering with which they may be entrusted. We also hope that the inspections likely to be made of bridges all over the country will result in the replacement of the defective ones by those of approved design and honest materials and workmanship.

BRIDGING NAVIGABLE STREAMS.

THE letter of the Secretary of War to the Senate, of date February 24, 1887, transmits some important reports on the subject of bridging navigable streams.

Respecting the Poughkeepsie Bridge, Col. McFarland reports that it will have a least height above water of 130 feet, and spans all over 500 feet each, and concurs with General Newton in recommending that no opposition be made to the structure.

Respecting the M. & N. W. R. R. Bridge across the Mississippi at St. Paul, there are letters from the U. S. Attorney, the Attorney-General, etc. The latter expresses the opinion that "until Congress makes some adequate provision upon the subject, the officers of the United States can in this case take no action to enforce the rights of the Government, and give effect to the duty resting upon it to protect the navigation of the Mississippi River." In this case there is a conflict of opinion as to the adequacy of the provision made for navigating the stream; but this decision is a very sweeping one, and shows the danger to be apprehended from this state of things. The Attorney-General also says that "the public law of the United States appears to leave the vindication of the right of navigation to those who sustain injury thereto from unlawful obstructions"; but this looks like locking the stable after the horse is stolen.

There are also reports by Colonel Gillespie on obstructions by bridges to Fort Point Channel and Charles River, Boston; by Colonel Elliott, on the draw across the Pawcatuck at Providence; by Colonel Houston, on the bridge at Stratford across the Housatonic, and by Colonel Robert on various bridges in New Jersey and Pennsylvania. By William F. Smith, U. S. Agent, on draws in Delaware, and also reports by Lieut.-Col. Hains, Lieut.-Col. Craighill, Mr. Abert, Captain Hinman, Captain Bixby, Colonel Gillmore, Lieutenant Black, Captain Hoxie, Major Damrell, Major Heuer, Captain Willard, Captain Taber, Major Mackenzie, Major Allen, Lieut.-Col. Barlow, Major Stickney, Captain Davis, Major Handbury, Major Adams, Captain Payson, and Captain Powell, all of the U. S. Engineers. These reports enter very fully into the general subject of obstructions to navigable streams, and show the necessity for arousing the public mind to the great losses which are likely to ensue from the persistent neglect of this important matter by Congress.

OUR BRITISH CORRESPONDENCE.

The Electric-Light in Collieries—Mechanical Education for Workmen—Modification of Electric-Light Bill—Cutting down an Architect's Commission—Taxation of London Manufacturers.

LONDON, March 9, 1887.

THE electric-light seems destined to play a part in the future in connection with colliery works, and if by so doing, any proportion of the explosions can be avoided and lives saved, the promoters of this particular application may be congratulated. The Gulcher Electric-Light and Power Company have recently erected an installation of sixty-five 16-candle-power Swan lamps at the Standard Colliery, Yorkshire. Thirty of these lamps are for underground use. The cable ends at the bottom of the pit in a slate terminal box, carrying positive and negative terminal bars. Three circuits of $\frac{7}{18}$-inch insulated cable go thence to the underground lamps.

A RESIDENCE AT CLIFTONDALE, MASS.—FRANK E. WALLIS, ARCHITECT.

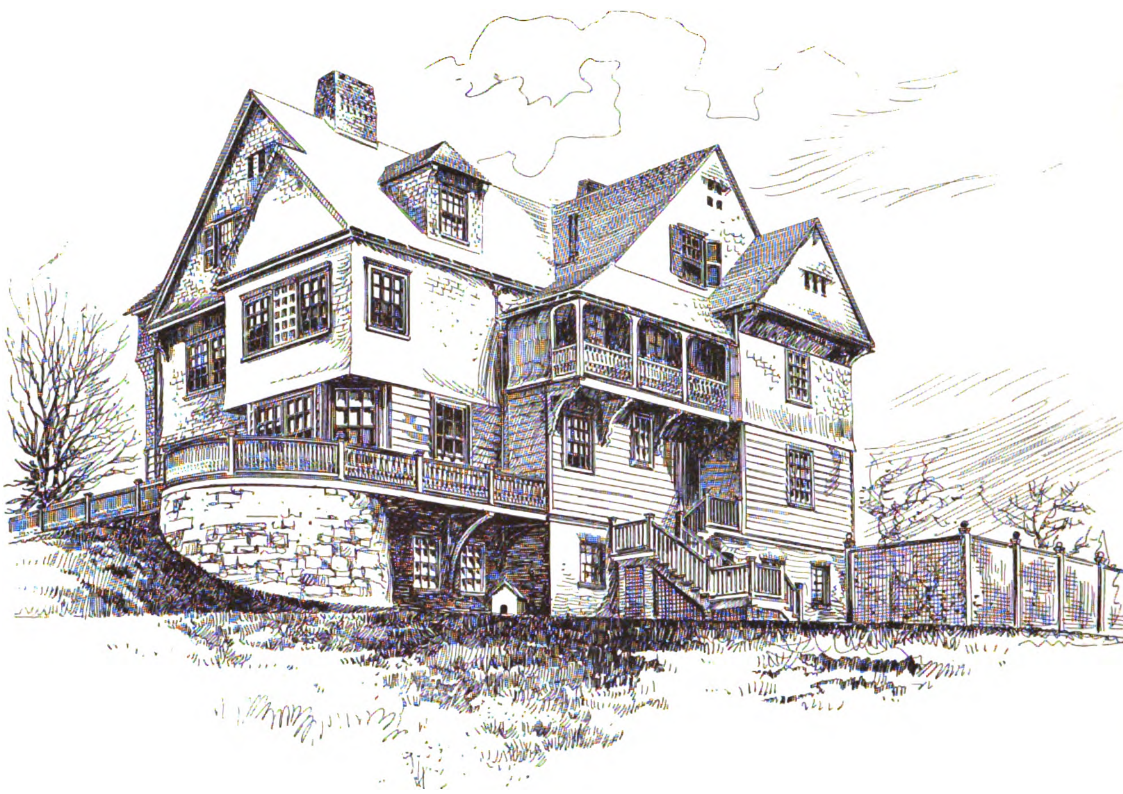
With a view to the better education of workmen engaged in industries in which art is more or less concerned, it is announced that the Lords of the Committee of Council on Education have decided to make arrangements for the admission of a limited number of students into the South Kensington schools, library, etc., for periods of from two to nine months' instruction, without any charge whatever. The only necessary qualification on the part of the individual workman for taking advantage of this offer is, that he shall have sufficient knowledge of drawing and sketching to be able to profit by the opportunities afforded, and that his employers shall undertake to maintain him during the period of instruction. It remains to be seen whether the employers will consider that they have any, and, if so, sufficient guarantee that the developed abilities of the workman whom they have maintained shall be adequately devoted to their interests.

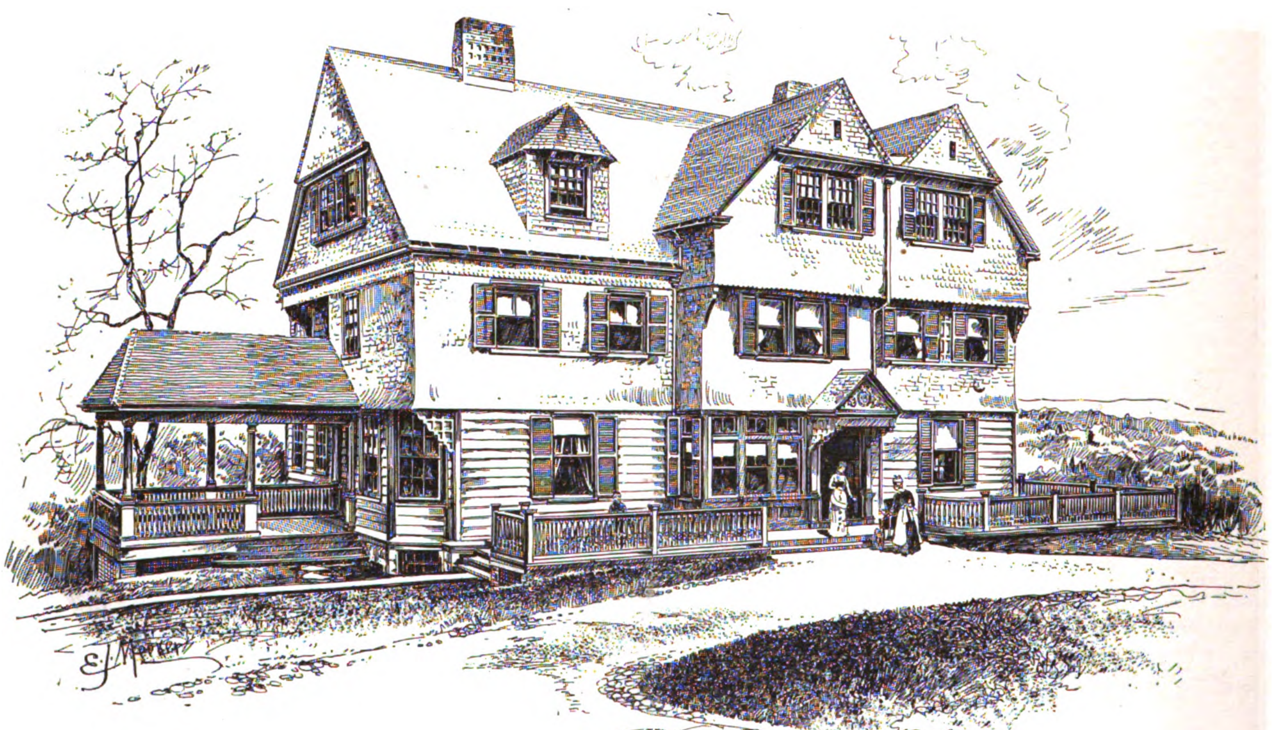
Electric-light legislation is again receiving considerable attention, and it is hoped in electric-light circles that the practical prohibition of its public use will be rescinded. It may be remembered that in 1882, at the time of the electric-light mania, when companies were being promoted every day, the Board of Trade obtained "panic" legislation, with the avowed object of preventing a new monopoly, such as at present exists in the case of gas and water companies. They effected this by simply enacting, through their Electric-Lighting Bill, what is known as the "old-iron clause," enabling corporations and local authorities to acquire the working plant, etc., of any electric-light company serving the district at first cost of materials, etc., without allowing anything for good will, etc., after such company had been in existence some twenty-one years. Lord Thurlow has now introduced a bill into the House of Lords, where it has been read a second time, doing away with this objectionable clause and placing the matter upon an ordinary commercial basis.

The Judge of the Swansea County Court cannot be said to appreciate very highly the architectural profession. In a recent case a firm of local architects, Messrs. Bucknall & Jennings, were summoned by a builder for the return of moneys paid for bills of quantities, lithographing, etc., in connection with work done. The plaintiff held that he should not be called upon to pay for such, and stated that he had paid the sum in error. The Judge recognized the necessity that architects should be paid for work done, but considered two and one-half per cent. too high, and awarded instead an amount equal to about one per cent. The gross amount of the architect's charge was £50.

Notwithstanding the fact that considerable agitation has been created by the proposed abolition of the coal and wine dues, Doulton & Co. are the first people to point out that these impositions entail distinct disadvantages on the London manufacturer. By their maintenance he is handicapped to the extent of a shilling a ton on his coal—of course, a very serious item when competition is necessary against the manufacturer outside the London radius who has not the impost on his coal.

SAFETY VALVE.

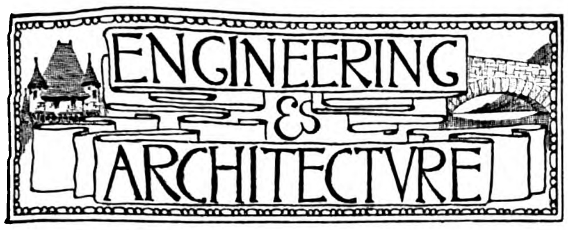




THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCE OF ALFRED BOWDITCH, ESQ., JAMAICA PLAINS, BOSTON, MASS.

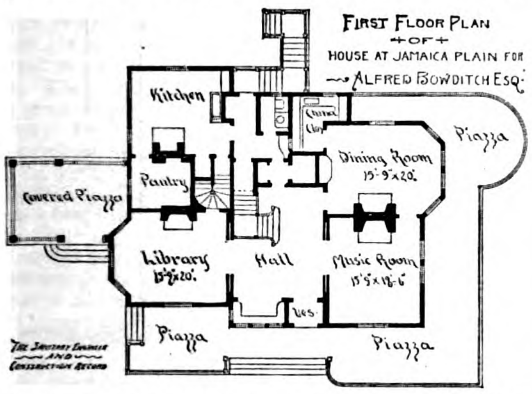
E. M. WHEELWRIGHT, ARCHITECT.



OUR SPECIAL ILLUSTRATION.

RESIDENCE AT JAMAICA PLAINS, MASS.—E. M. WHEELWRIGHT, ARCHITECT.

THE subject of our special illustration this week is the residence of Mr. Alfred Bowditch at Jamaica Plains, Boston, Mass. The basement is of stone and brick, with wood superstructure. The walls of first story are covered with



molded siding, the second story with shingles. First floor, principal rooms, halls and staircases are hardwood; elsewhere whitewood, stained, except kitchen, which is Georgia pine, and bath-rooms cherry. The cost was $20,000. The architect was E. M. Wheelwright, of Boston.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A COTTAGE AT CLIFTONDALE, MASS.—FRANK E. WALLIS, ARCHITECT.

THE subject of our vignette illustration is a house for Mr. E. J. Bryant, at Cliftondale, Mass., cost about $4,000; clapboarded firrt story; shingled above; redstone foundation. The architect was Frank E. Wallis, of New York.

MEER ALLUM LAKE.

THE description of this structure here presented is taken from *Indian Engineering*, our drawing being made from a sketch also in that journal. The information is too meagre to be made the subject of intelligent criticism; while it is certainly "unique," we are not at all prepared to admit that the resistance to the pressure of the water is obviously more formidable and complete than from a dam built according to the ordinary practice.

The description gives merely the span of the arches, with no statement as to exact form. They appear to have a versed sine of about 1 to $3\frac{1}{2}$ of span. The grand curve has a versed sine of about 1 to $2\frac{1}{4}$ span. The masonry is stated to be 4 to 5 feet thick on *top*, but no thickness is mentioned at the bottom; and the greatest height we may assume to be 50 feet. If the *drawing* be correct, the offsets in the masonry courses are about equal to the rise, in which case, the bottom width, as there is a batter shown inside also, would be over 55 feet—probably at least 60 feet. In addition to this there is shown at each cusp in the dam an enormous abutment, approximately equal in depth to the versed sine of the arch. To add to the complexity the general ground plan of the whole is shown to be on a curve. It is evident at a glance that the general curve adds nothing to the stability, since the smaller curves at the ends are in no condition to transmit the general thrust to the banks.

The strength of the individual arches as such becomes therefore the test of strength. It can hardly be questioned that they are strong enough; but we think the number of engineers is very limited who would choose this form for economy. The same material put into a straight dam would in the first place be much more likely to be tight, would probably be more stable, and would cost much less.

Radial joints and curved surfaces are much more expensive than rectangular joints and surfaces. If the curved parts are to act as arches, the abutments must be heavy enough to take all the thrust. If the curvature be considerable the length and quantity of masonry are sensibly increased. For example, in this case the length of the small arcs is about $1\frac{1}{4}$ times the span, and the length of the large arc nearly $1\frac{1}{2}$ times the span; so that the total length is about $1\frac{7}{8}$ times that of a straight dam. In comparing this with a straight dam, therefore, the section can be multiplied by the factor $1\frac{7}{8}$, and even then we have made no allowance for the twenty or more abutments.

Again, when we contemplate what the thrust from a long, high, curved dam would be, and the *enormous* abutments that would be required at each end to properly transmit the thrust to the earth, we get a most potent argument against the introduction of curvature. If it be undertaken to transmit to the banks a *part* only of the thrust from the water, we have the indeterminate problem of how much? and engineers very wisely avoid all such where possible.

This plan is interesting as a novelty, but is certainly not to be commended. To go into a mathematical demonstration would be a tedious problem, and we prefer to criticise on general grounds.

THE TELEPHONE IN FRANCE.

IN an article in *La Semaine des Constructeurs* it would seem as if a solution of the question of low rates on telephones might be realized in France ere long. At present there are in France two telephone systems. One system is managed by a company whose charges are $120 per annum in Paris, and $80 outside of the capital. The other system is controlled by the State, which charges $40 per annum plus a certain percentage of the cost of the lines. The charter of the company expires in 1887, and it is proposed to form one company with a capital of $20,000,000, one-fourth stock and three-fourths bonds, to be used in buying up the existing lines and building new lines. The State is to become owner of the whole plant as soon as it is in working order. The company asks for a monopoly of the business for thirty-five years. The income to be applied first to paying off the capital; the State to have 15 per cent. of the profits; the State to control all construction and management; all employees to be naturalized Frenchmen, and to be sworn to professional secrecy; the tariffs to be lowered in proportion to the income; the State to have the right to buy up the charter after fifteen years.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XV.

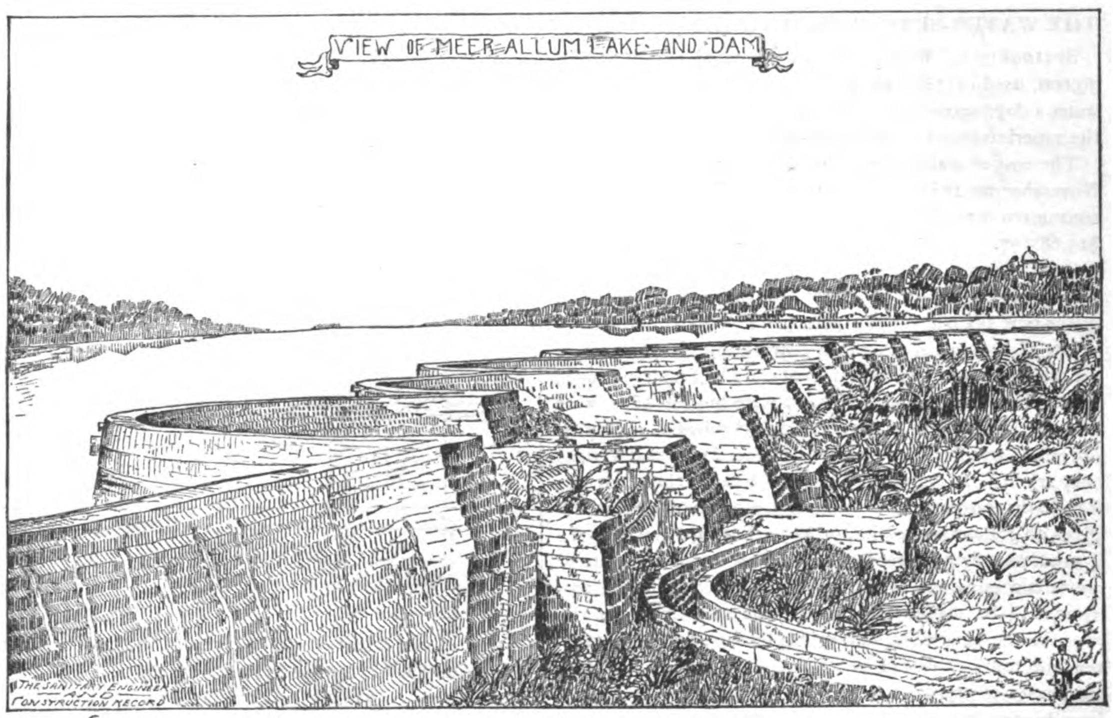
(Continued from page 372.)

WE resume in this article the description of work done at the Equitable Building in this city. Fig. 58 illustrates a repair to the support of a beam made a number of years ago. A very heavy safe was to be placed in such a way as to concentrate an excessive load on this one beam near the end. Before doing it a test load of iron was piled on the floor equal to the weight of the safe. This caused the bracket under the beam to yield slightly, and, to strengthen it, the iron yokes shown were then fitted and put on, and screwed up while red hot. This straightened up the bracket and gave it additional strength, so that there was no further trouble. A heavy brick wall above the box-girder kept everything in place.

Figure 59 shows a plan and elevation of a special hoisting machine, built by the Lidgerwood Manufacturing Company, of New York, for the contractor for building the stone-work. The machine has two cylinders, $8\frac{1}{4}$x10 inches, with reversible link motion, and two drums, 16 inches in diameter, with 42-inch face and flanges 42 nches in diameter, to give room for winding 500 feet of 2-inch diameter rope. The gearing for fast speed is 5 to 1, and slow speed $17\frac{7}{10}$ to 1, and the machine is guaranteed to hoist readily ten tons on a single rope. The intermediate shaft has a capstan-head for use in overhauling. The speed for the fast gear with light loads will wind 125 feet to 225 feet of rope per minute, and the slow gear for heaviest loads about one-third of this.

The special use of the link motion is to be able to always have the ropes wind in the same direction on the drums independently of whether the fast or the slow gear be thrown in. There are strap-brakes to each drum, operated by foot-levers, for lowering by, and a cone friction drum to each for hoisting by, so that each can be operated independently of the other, except that the speed of both is always alike, being fast when the lower pinion is used and slow when the intermediate shaft is in use.

The machine is very substantially built and it is understood that its cost was under $2,000.



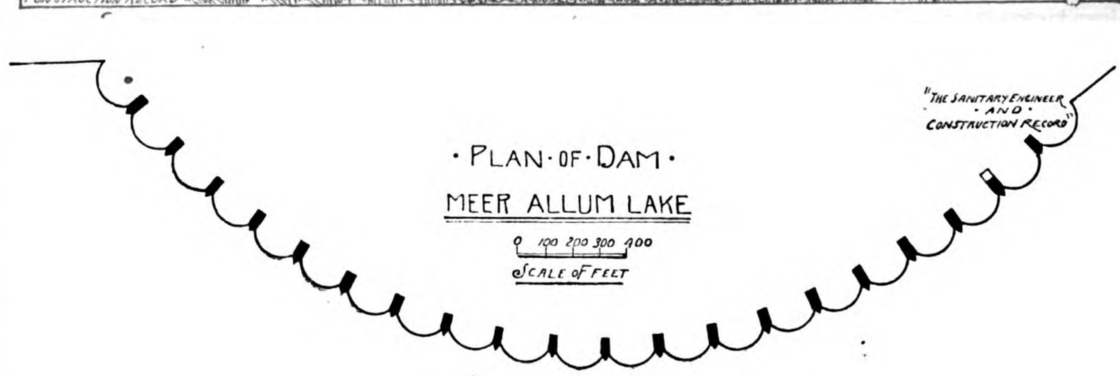
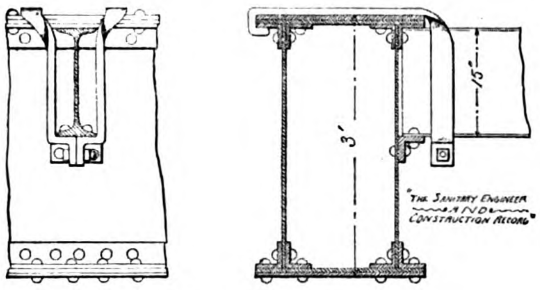


Figure 60 is a form of derrick adopted by Messrs J. B. & J. M. Cornell for use in raising and placing the iron-work of the building.

We are indebted to their foreman, Mr. Gardner, for the details. It is really a very large breast derrick, having a lift of nearly 60 feet. The windlass for hoisting has a strap-brake attachment for lowering, operated by the foot, and two capstan-heads for light work. The speed can be made to vary as 1 to 1, 1 to 3, or 1 to 4, and the derrick has proved very effective in use.

It may be well to remark in general as to the use of hoisting machinery, that in lowering, the strap-brake gives a smoother motion than the cone friction. Referring



REPAIR OF GIRDER CONNECTION
EQUITABLE BUILDING
FIG·58

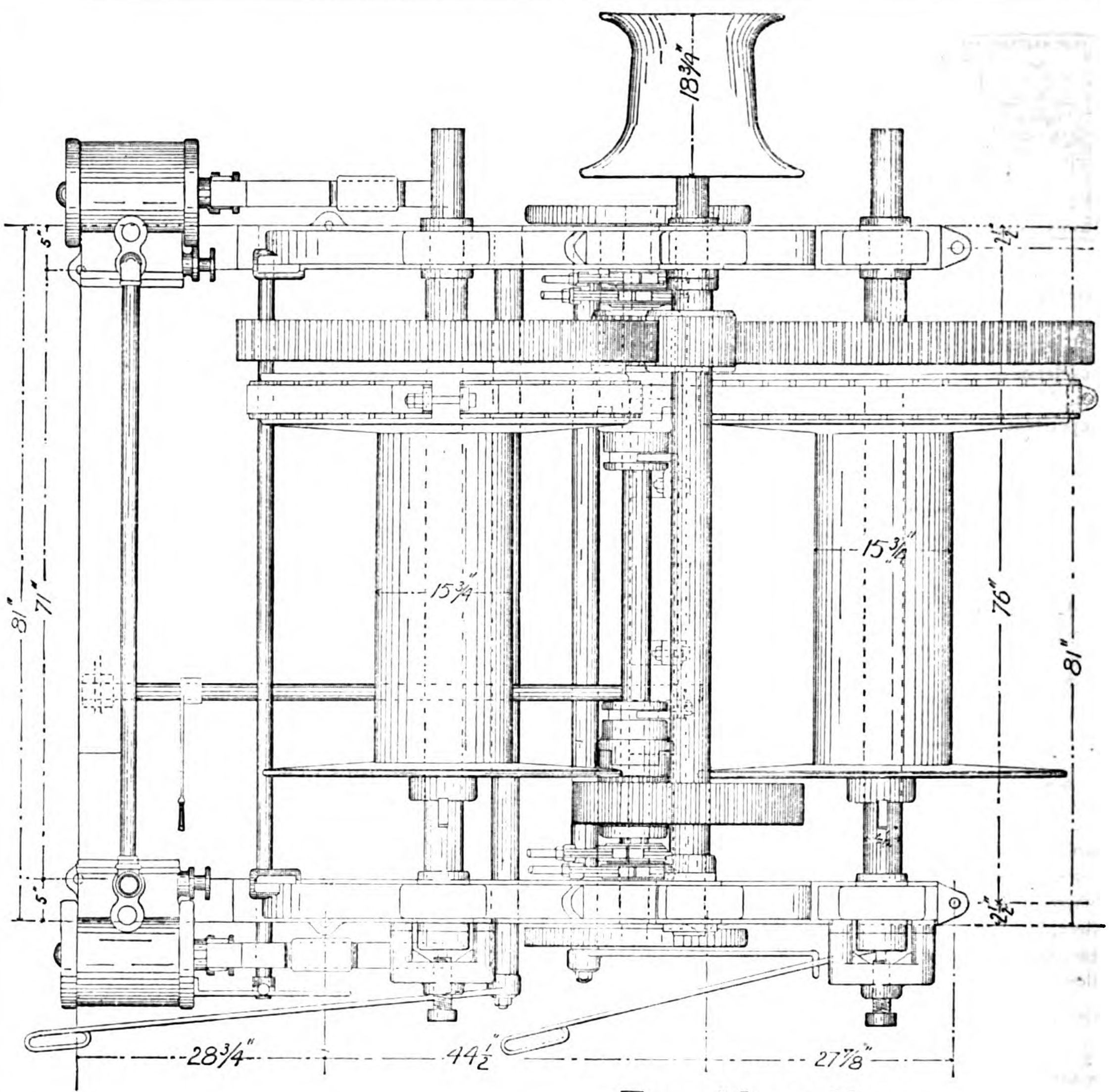
again to the Lidgerwood engine, described above, we would add that there are two other methods of lowering made possible by it: First, by the admission of a small quantity of steam direct, and letting the load back the engine down against the steam. For this purpose the pet-cocks are all connected so that they can be opened by one motion. This is necessary to allow the water of condensation to escape freely.

The second method is to use the link motion for hoisting, holding, or lowering at will.

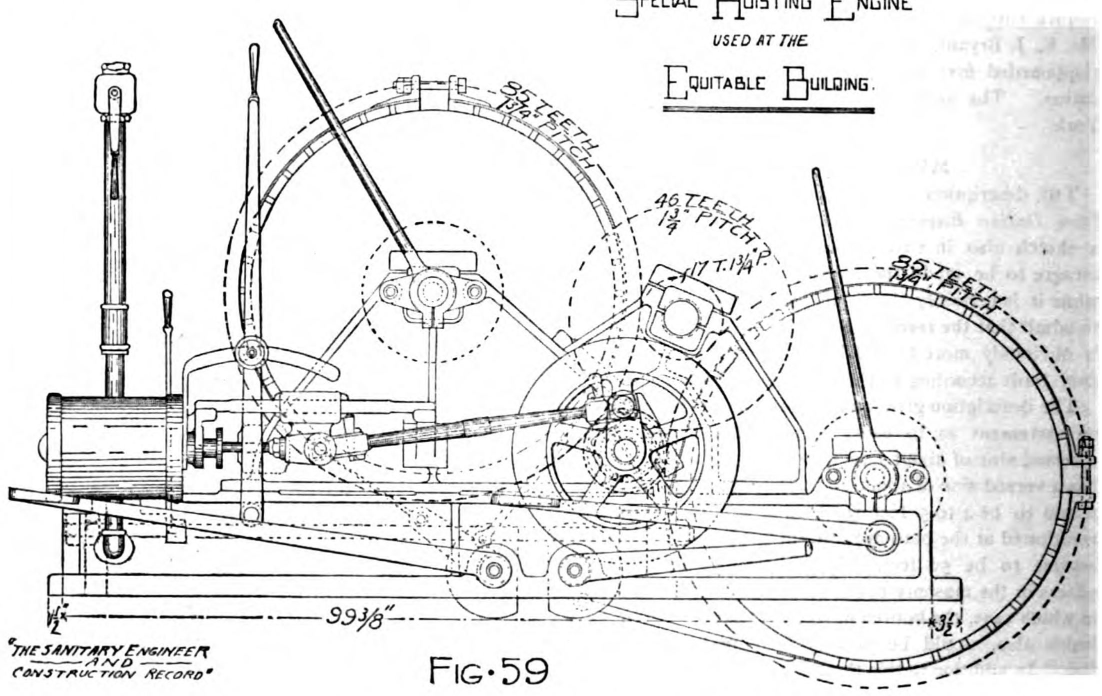
By such means the lowering is under absolute control, and can be made as slow as may be desired.

Our next article will complete the description of the Equitable work.

(To be continued.)



SPECIAL HOISTING ENGINE
USED AT THE
EQUITABLE BUILDING.



FIG·59

THE WATER-SUPPLY OF SPRINGFIELD, MASS.

Springfield, Mass., with an estimated population of 39,000, used in 1886 an average of 3,750,000 gallons of water a day, according to the report of Mr. J. C. Hancock, the superintendent of the water-works.

The cost of maintaining the works for the year ending November 30, 1886, was $30,171.61, and the revenue from consumers was $106,875.33, and from the public funds $13,885.97. The bonded debt of $1,200,000 carries an interest account of $82,000, so that the net revenue from the works was $8,589.69. The amount expended on extension of the pipe system was $14,747.15. The system now comprises 78.65 miles of main and distributing pipes, on which are 696 gates and 560 fire-hydrants. The first pipes used in the city when the present works were built in 1873, were of sheet-iron lined with cement, and 35 miles of such pipe are still in use, but they are being replaced with cast iron, as they are in a bad condition and will all have to be taken out. The daily consumption of water is 3,750,000 gallons, which gives 96 gallons per capita, or 829 gallons per tap. Of the 4,519 taps only 349 are metered. The excessive waste of water is complained of and a closer inspection of the services is to be made. The water was offensive from the algæ in the reservoirs during September. The superintendent thinks this can be obviated by some changes at the source of supply, as indicated in the following extract from his report:

"I am of the opinion that this vegetable life does not originate in the reservoir, or at least but a very small proportion of it. I am forced to the conclusion, after looking the question over carefully, that it is brought in from the Belchertown reservoir through Broad Brook Canal, in a state of solution, and when the warm weather comes on, grows as naturally as corn does when planted in good rich soil.

"The Belchertown reservoir controls a drainage area of 6.051 square miles, and sets back something like two miles, through a swamp varying in width from fifty to eight hundred or a thousand feet, covered with a coarse bog-grass that grows from two to six feet high, and a large amount of brush and trees in all conditions, many of which have died and fallen, presenting one of the most unsightly places imaginable for the collection of water.

"This vast amount of vegetation, decaying as it does in the water, vitiates the whole stream, and renders it unfit for use.

"This could be remedied by building a canal on the westerly side of the swamp, or, in other words, extending the present Broad Brook Canal to the head of the swamp, and taking the water at that point, where it is pure and clear. As the greater portion of the brooks enter the swamp from the westerly side, this canal would intercept at least ninety per cent. of the water collectible from this water-shed.

"The west branch of Broad Brook, having a drainage area of 2.297 square miles, empties into the Belchertown reservoir at a point fifteen hundred and fifty feet above the upper end of Broad Brook Canal. By extending this canal that distance, this water could be turned into Cherry Valley reservoir, and would, in all probability, give us all the water we need, until such time as a new main is laid from the city to the Ludlow reservoir.

"This water is unexceptionable in quality, and I would recommend that this work be done, and the Broad Brook shut off entirely. I think if this should be done, we could confidently anticipate a great improvement in the Ludlow water.

"I believe in going to the fountain-head to improve our water-supply; the reservoir has been built and ponded for twelve years—a sufficient length of time, it seems to me, to eliminate the greater portion, if not all, the deteriorating influence to be expected from the vegetable matter left in the reservoir when the water was first turned into it.

"The water now in the reservoir is, of course, of the same quality as that we have been using; it contains a large amount of objectionable material held in solution, and will have to work itself pure, unless we draw it off. I think, however, that if we put nothing but good water into the reservoir, nature will take care of that which is now stored there, and give us what we all desire—pure water."

HEATING RAILWAY-CARS.

Engineering, of London, thus describes a system invented by Mr. William Foulis, M. Inst. C. E., Manager in Chief to the Glasgow Corporation Gas-Works, for heating railway-cars in Great Britain:

"Mr. Foulis takes advantage of the fact that large numbers of them are already fitted with various forms of gas-lamps for supplying light; and his aim has been to bring the heat that is developed in the roof of the carriage while the gas is alight down to the floor of the compartment, so as thereby to keep the feet of the passengers comfortably warm, and the whole atmosphere of the compartment at an agreeable temperature. He uses water as the medium for transmitting the heat of the gas-flame from the one place to the other. A boiler is placed in the roof of the carriage over the flame of the gas-lamp. It is of very simple construction, and the principle on which the heater works is that the heat from the flame comes into contact with the boiler at the point where the water is hottest and leaves it where it is coldest. From this boiler there descend two pipes about one-fourth inch in diameter which are connected to two annular tubes placed underneath the carriage seat. The course which the two pipes take is down through the wooden partition separating the contiguous compartments. Hot water circulates through these pipes and annular tubes, and it returns to the boiler after having given off its heat. The reversal of the current is accomplished by allowing the hot water from the boiler to ascend in a tube a few inches in length, on the top of which there is a small valve. Having passed up this tube, and being unable to return to the boiler, the hot water is made to circulate downwards through the pipes. The annular tubes already referred to are about three and one-half inches in diameter and about eight inches long. They are laid at an angle under the seat, the upper end being raised as far as practicable. The pipe which conveys the hot water is connected to the top of these tubes, and that which carries the return current is connected with the bottom of the same.

Owing to the fact that the tube is placed at an angle, and that it is heated, an induced current of air is made to pass through it; and as the air enters the tube at the cold end, and leaves it at the hot end, it absorbs the maximum amount of heat from the water. The air flows from these tubes or heaters in a constant stream at a temperature of from 80 degrees to 90 degrees. It has been found that the ordinary size of gas-flame is quite sufficient to do the heating of a compartment, though the consumption of gas is less than one cubic foot per hour, and even during the coldest days of winter.

As regards the probability of the water in the apparatus freezing in cold weather when the carriage is not in use, it should be mentioned that congelation is completely prevented by mixing a given quantity of glycerine with the water. By way of testing the efficiency of this non-freezing mixture, the experimental carriage which has been placed at the service of Mr. Foulis was left exposed at night on a railway siding during the coldest weather of the past winter, without the slightest indication of freezing taking place in the water to which the glycerine had been added.

We may mention that the carriage used is a composite one of four compartments, the property of the Glasgow and South-Western Railway Company. The internal construction of the carriage was entirely rearranged under the superintendence of Mr. Foulis. During the past two months or so numerous experimental runs have been made with this carriage as part of a regular passenger train, several of them being to and from Carlisle. On one or two occasions the patentee has been accompanied by Mr. Smellie, locomotive engineer, and other leading officials of the Glasgow and South-Western Railway Company; and in all cases they have expressed themselves as highly satisfied with the results achieved by Mr. Foulis. The present writer had the pleasure of joining in one of the runs from Kilmarnock to Carlisle and back, when the weather was wintry in the extreme, all the hills for many miles being covered with snow. Inside the carriage the temperature was most agreeable, and in marked contrast to the outside. A thermometer hung in the compartment, in which there were only three persons, never fell below 52 degrees, and the extent of the range was only 2 degrees. On other occasions the temperature ranged from 56 degrees to 60 degrees.

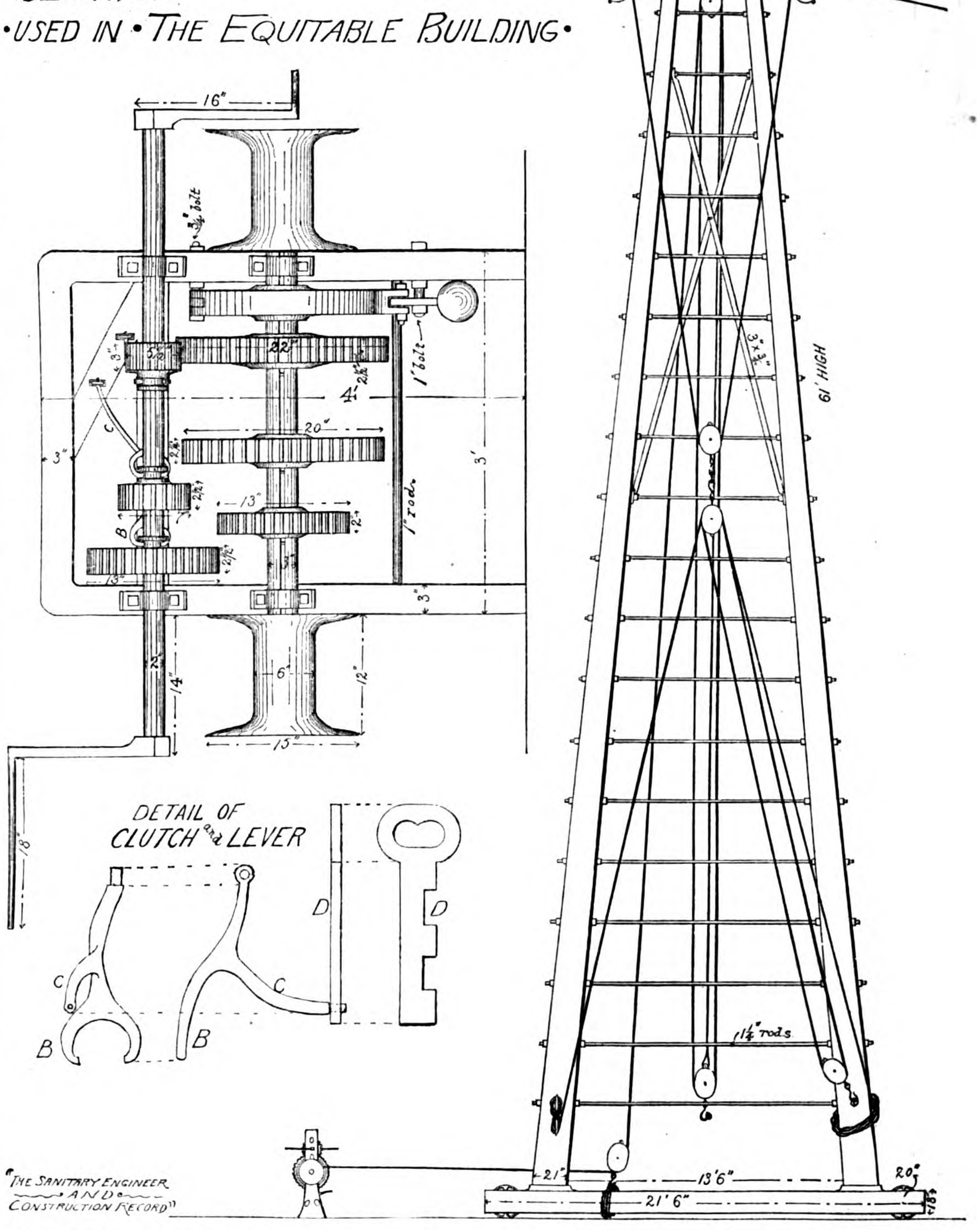
Of course, in carriages heated on the "Foulis" system the gas must be constantly burning—by day as well as by night; but if heating for the comfort of the passengers is to be done it matters not though the heat is obtained from a luminous flame, providing that it is comparatively inexpensive. In this case it is remarkably economical, while as soon as darkness sets in the gas flame does double duty, providing both heat and light.

BOSTON CITY ENGINEER'S REPORT.

THE report for 1886 of Mr. William Jackson, City Engineer of Boston, has been received. It contains the usual reports respecting the bridges of the city and condition of the work under his charge. A feature of interest to engineers is the description of the Farm Pond conduit and of the raising of the 48-inch water-main at the crossing of the Boston and Albany road. Both of these have been already described and illustrated in our columns.

FIG·60

DERRICK— ·USED IN·THE EQUITABLE BUILDING·



A DAM FOR THE WATER-SUPPLY OF SAN FRANCISCO.

THE Spring Valley Water Company has recently acquired title to lands on San Mateo Creek, to the south of San Francisco, where it is proposed to form a great storage-reservoir for the supply of the city with water. The watershed is drained by three streams, the San Mateo, Crystal Springs Creek, and San Andreas Creek. These streams unite just before they break through a barrier of hills on their way to the sea, and just below their junction a great dam will be built. A recent description of this work in the San Francisco *Chronicle* furnishes some particulars.

The dam will be 170 feet high from the creek bottom to the crest. Its length on top, across the ravine, will be 500 feet, while at the bottom it will be only 75 feet long. The materials will be clay, faced on the upper side with stone. It is stated that this facing will be the only stone used in the dam. The foundation will be a trench of puddle sunk to bed-rock. Before beginning work on the dam a tunnel will be driven through the hills on one side of the ravine. This tunnel, about 1,500 feet in length, will serve as a waste-outlet for the creek waters during the construction of the dam, and afterward will be used as a conduit in which to lay the iron mains. A gate-house will be built at the inner end of the tunnel, which will be a short distance above the dam, with openings and gates at various levels. This method, it is hoped, will avoid the introduction of water which may be brackish, muddy, or otherwise affected into the mains. It is believed that if water at a certain depth should be bad, water at other depths may be good. It is expected that the building of the dam and tunnel will take three years.

THE report of the City Engineer of Galveston, Tex., is just issued. It refers to the disastrous fire and floods of two years past, to the necessity of a more perfect system for carrying out permanent improvements, to the imperfection of the organic law as to the matter of assessments, to the necessity of filling up the low depression in the city, before permanent grades are established, to the necessity for concentrating the improvements on special districts, etc. He discusses at some length the subject of pavements, and to the need of positive restrictions upon the frequent tearing up of the same, and for proper replacement when it has been torn up. The expenditures for the year were $75,258.61.

PENDING the abolition of the car-stove, railway men may take a hint from the Boston and Providence accident on the 14th inst. On many if not all the local cars of the Dedham branch the stoves are placed in the centre of the car instead of at the ends. It would seem that this circumstance may account for their not taking fire. The stove at the end of the car appears to be the first thing smashed in an accident. The coals are then at once scattered among the timbers, which have been reduced to kindling-wood, and a fire is almost instantly started.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

HOT-WATER APPARATUS IN THE RESIDENCE OF W. H. CARRICK, ESQ., TORONTO.

THE accompanying plans and diagram show the hot-water heating-apparatus in the house of Mr. W. H. Carrick, of Toronto, Can.

It is selected because it shows the hot-water plant of an average city residence that would ordinarily be warmed by a furnace in a comparatively cold country, and is typical of the system of piping largely followed in Upper and Lower Canada in the warming of buildings by hot-water circulations.

The plant has been one winter in use, and has proved ample for the warming of a fairly-well-built wooden structure, that has been kept warm with water ranging from 120° to 190° Fah., according to the state and requirements of the weather outside, and from which deductions may be drawn leading to the formation of *data* for future reference by persons interested in heating problems.

It will be noted that the sizes of windows are shown, the cubic contents of rooms marked, the position of heaters shown, and their sizes marked, the figure attached to each indicating the number of "Bundy" loops, each loop being nominally 3½ square feet of heating-surface in the hot-water radiator.

For any one who wishes to work out the wall-surface we give the heights in the clear of floors. The principal or *first* floor (called in Canada ground floor) 10′ 6″; the *second* floor (called in Canada first floor) 9 feet, and the *third*, or attic, 8 feet.

The sizes of the mains and floor-pipes are marked on the plans, and the boiler is a No. 25 Gurney; the consumption of anthracite coal for a season being seven tons and just about 100 pounds per day in cold weather; the climate of Toronto differing very little from the cities of Northern New York, Ohio, Michigan, Western Pennsylvania, and the Eastern States. This then, may be taken somewhat as a guide to the plant and its maintenance for a $5,000 house on a 20-foot city lot in the new district of New York or in Brooklyn.

The diagram shows the skeleton apparatus, and a reference to the plans will show its relation to the house. The boiler is in the front cellar, pretty well central. There is some advantage in having a hot-water plant balanced in this respect, though when it cannot be carried out larger flow-pipes to the long side will compensate for the increased distance. The radiators marked A in the diagram are on the principal floor, those marked B are on the second floor, and the ones marked C are on the top floor.

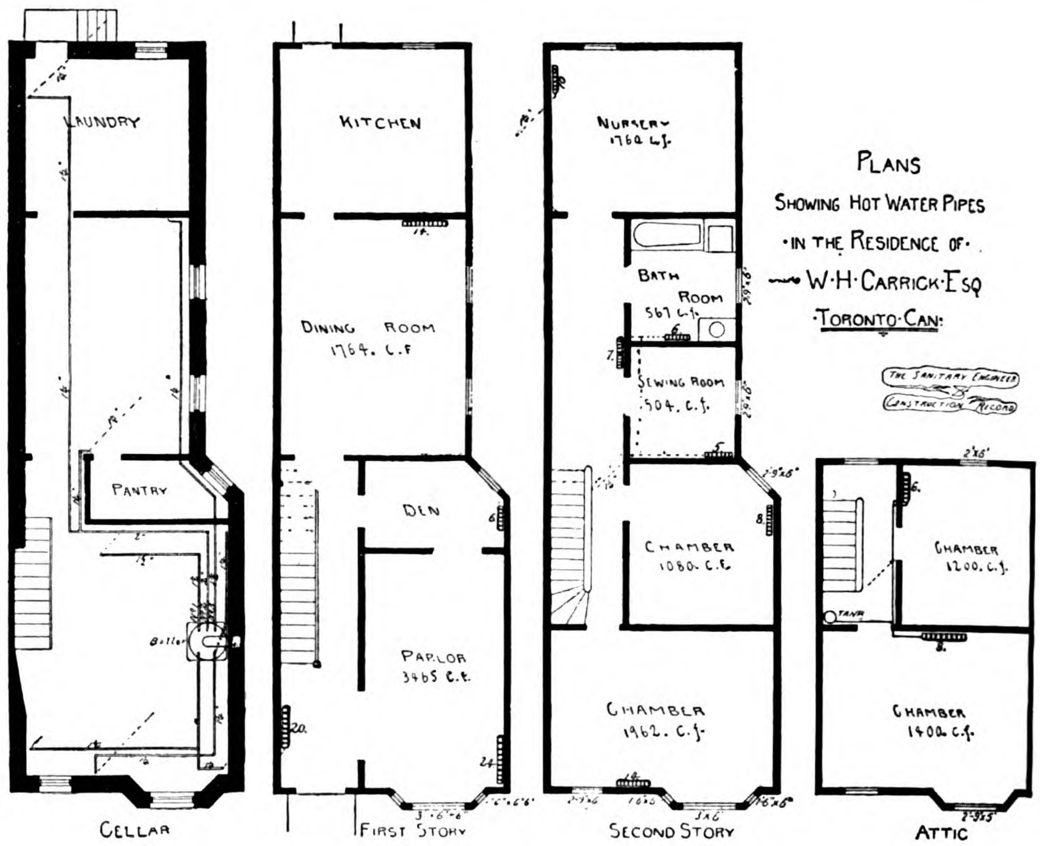
The circuit No. 1 starts from the boiler 1½ inches in diameter, runs along with the rest of the pipes to near the pantry, where it turns upward and runs through the partition to the top floor, where it comes out and branches to the two radiators and expansion-tank.

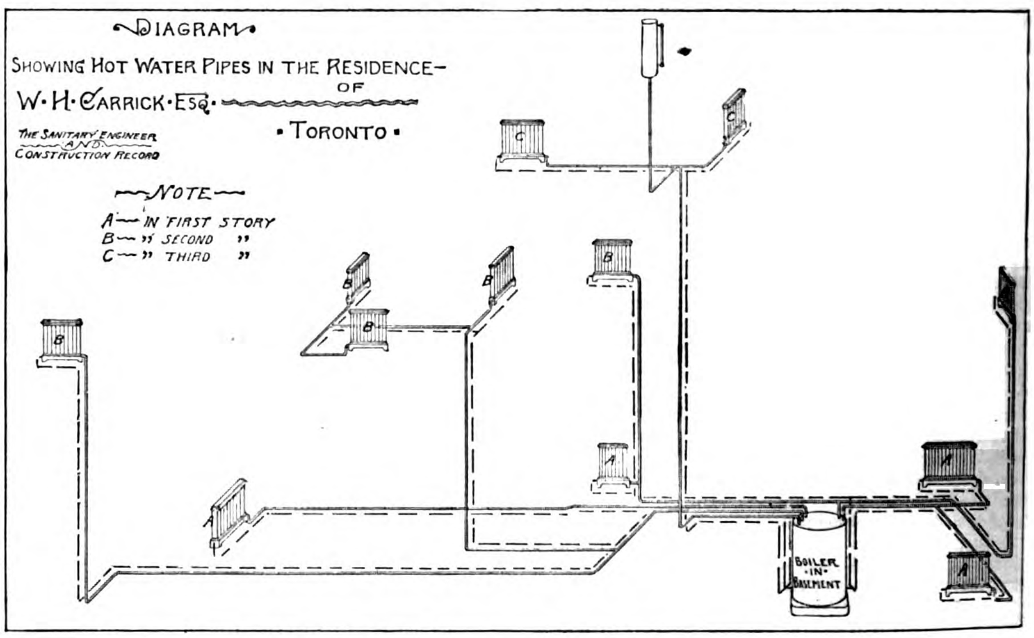
Circuit No. 2 starts from the boiler two inches and continues on to the end of pantry where it has a tee 2x1¼x1¼; one branch of which goes along parallel with side of pantry to pantry-door and then goes up through the partition and feeds sewing-room, bath-room, and upstairs hall. The other branch runs straight to the back end of house, and up through the kitchen to the nursery, where it heats the 1x10 radiator near the window. It may seem strange that this break was made in this way, but it was found when split at the point where the first pipe went up that the circulation was very sluggish and that the nursery radiator did not heat properly, hence the change of running the two pipes parallel to this point.

Circuit No. 3 starts from boiler 1½ inches in diameter, and heats the 6-pipe radiator in the den, and then continues 1¼ on to one radiator in dining-room which has 14 loops.

Circuit No. 4 starts from boiler two inches in diameter, and branches to a 1½-inch pipe to the lower hall, and 1¼ inches to parlor.

Circuit No. 5 breaks at the boiler into two 1¼ pipes, one going to front chamber where it heats the fourteen loops, and the other to the back chamber (second floor), where it heats the eight loops.





The flow and return pipes of a circuit are exactly alike in size and almost identical in the manner of being run. The pipes are near the ceiling, with a pitch of about one inch in ten feet.

Each radiator has an angle-valve on the inlet end and an air-cock in the top chamber. Although air collects in this chamber a neglect of a week is not sufficient to affect the flow of the water. The dotted lines in the plan indicate pipes under floor or in partitions, while the dotted lines in the diagram indicate the return flow-pipe. The pipes through the cellar are covered with a plastic non-conductor. On the expansion-tank is a glass to show the height of the water, and a connection with the city water-pipe is made to be used when required, but the waste is so small a ball-cock was not considered necessary.

The work was done by W. J. Burroughes, of Toronto.

ROCHESTER, N. Y.—It is reported that there is to be a movement to have nine hours made a day's work by all the building trades here. A large amount of building is projected. It is said that contractors are signing no building contracts without a proviso that the work will only be performed in event of peaceful relations with the men, and will become void in case of a strike. Most of the contracts are being let in this way. If the carpenters strike, scores of contracts will be declared off.

HEATING AND LIGHTING EXPERIMENTS.

THE Wagner Sleeping-Car Company has fitted up a palace-car with a system of electric-lighting, and it was started from the Grand Central Station Wednesday night for Albany. No official report of how the experiment worked was received yesterday. The New York Central managers are fitting up an ordinary coach with lights to be fed from a stationary electric battery and it will soon be started between here and Poughkeepsie. The experimental train to run between New York and Poughkeepsie to test the operation of a patent steam-heating apparatus is expected to come down from the latter place to-day and be started from here on its regular service.—*New York Times.*

ASSEMBLYMAN KENNY, of New York, has invaded Brooklyn with a bill, presented this morning, providing that all fat-renderers, bone-boilers, and bone-grinders within the limits of the town must so conduct their business as to preclude any offensive odors, and that no tainted animal matter may be handled, nor shall such be used in the manufacture of feed products. The sewers may not be used to carry off the refuse, and any violation may be punished by not less than one nor more than six months' imprisonment, or a fine of $250, or both.—*Brooklyn Eagle.*

CEDAR BLOCKS VERSUS ASPHALT FOR STREET-PAVEMENTS.

CEDAR RAPIDS, IOWA, March 16, 1887.

SIR: Do you think cedar blocks for street pavements as healthful as asphalt or other non-absorbent material? For like reasons, are the blocks when placed on boards and not *treated with* creosote as good as when treated and put on concrete? Respectfully yours,

JOSSELYN & TAYLOR.

[Answering the questions of our correspondent in order, we would say:

First—That on general principles, that pavement from which water passes away with the least percolation to the soil below and which can be most thoroughly and easily cleansed is the most conducive to health.

Second—*No* pavement placed on boards or directly on the earth is as durable as when placed on concrete; this is the universal verdict of all municipal engineers who have had opportunity to observe the matter, and the latest practice in France and England, where wood has been used, is to make a carefully formed and substantial concrete foundation for the blocks.

Third—Creosoting undoubedly adds to the life of the blocks, by making them wear out rather than decay irregularly. This question is complicated by the secondary ones of amount of traffic, kind of timber, care in selection, proper seasoning, etc.

Abroad a most rigid inspection is made, the blocks are thoroughly seasoned and thoroughly creosoted.

Fourth—The selection of a pavement should be guided among other things by the question of amount of traffic. On some streets in our cities nothing will stand the wear but the best granite blocks. Original cost oftentimes becomes also the deciding motive. We think it can scarcely be questioned that asphalt is superior to wooden blocks, provided other considerations do not essentially alter the conditions.]

DISTURBANCE OF TRAP-SEALS.

SIR: The accompanying diagrams show the general plan of the plumbing fixtures of a suburban dwelling, the relative length of the waste and vent pipes together, and their connection to soil-pipe, cesspool, and kitchen flue. It has been noticed that when the wind is blowing a gale, with a zero temperature without doors, the trap of basin No. 1 unseals. This has been made plain by a roaring sound proceeding at the wash-basin which disturbs the occupant of the room, who, upon his arising from bed, has stopped the noise by letting a quantity of water flow through the basin into the trap. A strong fire was burning in the kitchen range and the flue was well heated when this occurrence was last noticed. The temperature within doors was of the usual furnace-heated house. The foot-vent was covered as shown to guard against condensation and formation of ice at the point within the main drain where the air-vent connects with it, trouble having been experienced in the past through such cause. Will THE SANITARY ENGINEER AND CONSTRUCTION RECORD please give its friends the benefit of its explanation of the cause of this trouble? E. H.

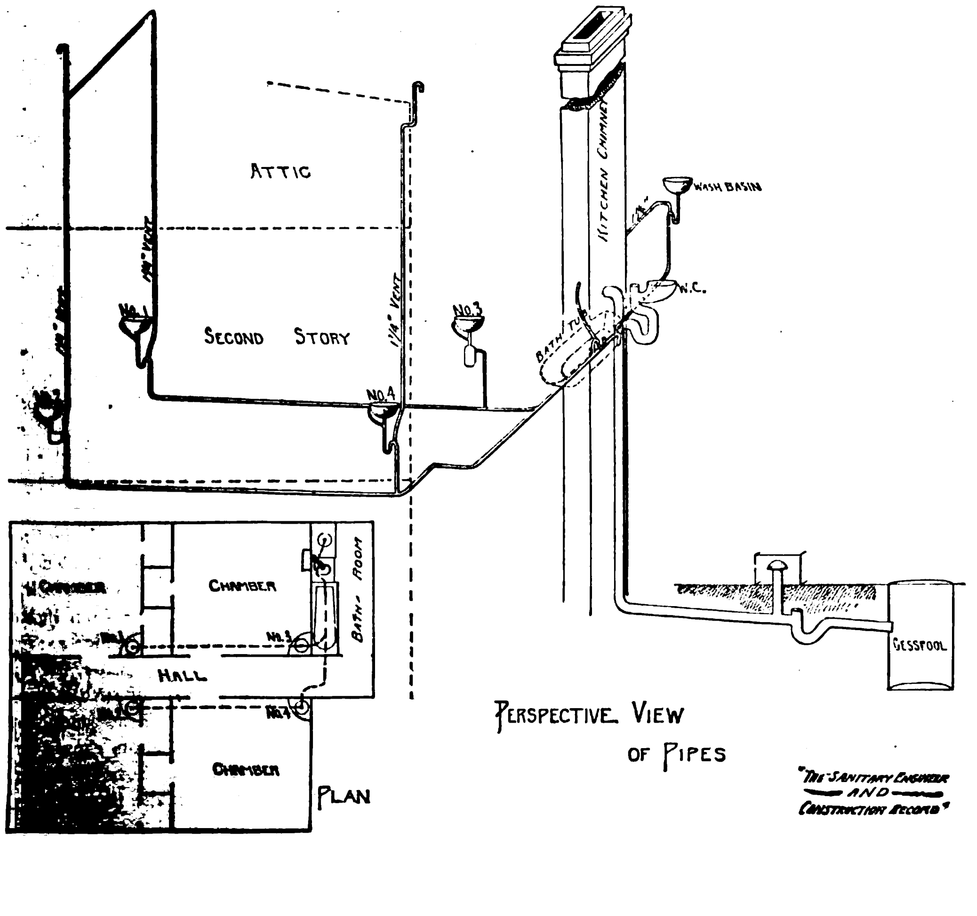
N. B.—The vent-pipes are 1¼ inches and the waste and traps 1½ inches. E. H.

[Should there be a considerable discharge of water at the water-closet, or should a wad of paper pass through the soil-pipe (whether there are prevailing high winds or not) we should expect basin No. 1 to be the first to give trouble by having its trap unsealed, or sufficiently so to cause a gurgling noise under slight differences of wind-pressure. The reason of this is the greater length of the vent-pipe to this basin, the fact of its being a branch of another vent no larger than itself, and the vent beyond the basin being too small to supply promptly the air needed in the absence of an independent soil-pipe, and the extra turns in the pipes, all of which cause resistance to the free passage of the air.

It would be better, also, if the vent-pipe were independent of the waste—that is, the trap to enter an independent waste-pipe instead of being wiped into the pipe when it forms the end of a branch line. The draught of the chimney was probably not enough in itself to draw out the seals of the traps. It may, however, assist any other agency, and more especially as your foot-vent was stopped. Of course you know it is wrong to stop the foot-vent for several reasons: the first is, you are not airing your soil-pipe, and the second, you are, in this case, drawing air down your trap-vents to supply the air drawn off by the chimney. If air is always allowed to pass in at the foot-vent it will not freeze; but if warm air from the house is by any means driven out, then the moisture in it will condense and freeze in cold weather.

If your freezing is caused by the foot-vent being in a low position, so snow or water can collect about it, have it placed higher and have it open. In thus attempting to account for the syphoning of your traps we do not wish to be understood as at all admitting that this plan of arranging the drainage-system of a house is at all correct. Indeed, we consider it radically wrong. The plan required by the New York plumbing law and that of all cities having a plumbing law should be followed.

These laws prohibit running a soil-pipe into a chimney, but require it to be extended through the roof. Fixtures remote from this soil-pipe must drain into an independent waste-pipe, the traps of each fixture being provided with an independent vent-pipe. See also Regulations of city of Rochester, printed on page 187, issue of January 22.]



Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

REGARDING THE STUDY OF ARCHITECTURE.

An officer of the army at Fort Snelling, Minn., writes us as follows:

"My son, twenty years of age, about to complete his sophomore year in the University of Minnesota, will probably study architecture, and I desire to obtain some information in regard thereto. I take the liberty of asking a few questions. Possibly the answers to these questions would interest a good many of the readers of your journal, and you might think best to take up the matter in print.

"Is it best for a young man desiring to study architecture to graduate at some technical school affording instruction in that branch before entering an architect's office, or should he see something of the practical side of the subject in an office before attending such a school? What schools in the United States give thorough and adequate courses of instruction in architecture?"

[Columbia College School of Mines has a regular course in architecture, under Professor W. R. Ware; also, the Institute of Technology, Boston, under Professor T. M. Clark; Cornell University, Ithaca, N. Y., under Professor ————; University of Illinois, Champaign, Ill., under Professor N. Clifford Ricker.

The question as to the advantages of having served a term in an architect's office before taking the full course is one which we shall discuss in a later issue. Meanwhile, we shall be glad to publish the views of those of our readers who have considered the matter.]

COLLAPSE OF A ROOF OF NORWAY IRON-WORKS, SOUTH BOSTON.

NEW YORK, March 21, 1887.

SIR: In reading your correspondent's account of the collapse of the roof of the Norway Iron-Works, South Boston, in the March 19 issue of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, it does not appear when and how it failed. Can you make it more clear? A.

[In reply to our correspondent, we would say that by an oversight our draughtsman omitted to indicate on the drawing of the truss that failure occurred in the left-hand portion of the arch in the panel next to the crown. A casual examination (see illustration on page 400) shows at once that this portion of the arch can afford no resistance to a load tending to flatten it, such as the snow lodged against it was, beyond the stiffness of the rib itself, as the ties on that side would not be called into play. Bracing in the panels would have made the upper and lower members act like a beam, and would undoubtedly have added to the strength of the roof, but the style of roof is not one to be commended.]

WHY WATER IN ELECTRIC BATTERIES DOES NOT FREEZE.

26 BAYLE STREET, MONTREAL, February 26, 1887.

SIR: We have a number of electric batteries (Leclanché cells) in use for working electric bells. Two sets of them are in places where they are fully exposed to the cold—very severe and long-continued this winter—and we fully expected to have had trouble from the water freezing in the jars and surrounding the porous cups, but the water has not frozen. Now, what has prevented it? Is it the sal ammoniac held in solution by the water, or has the electricity anything to do with it? Should like an answer through your columns. If an electric current will prevent water freezing, it is, to say the least, interesting and may prove useful. Yours, J. W. HUGHES.

[The presence of salts in water lower its freezing point; and it is because of the strong solution of salammonia in the cells that they did not freeze.]

SUBJECTS FOR PAPERS AT THE NEXT CONVENTION OF THE NATIONAL ASSOCIATION OF MASTER PLUMBERS.

THE Essay Committee of the National Association of Master Plumbers have made a very practical selection of subjects on which the local associations are invited to contribute papers for the next convention. The discussion of these subjects will add materially to the permanent value of the published transactions of the National Association. The circular sent out is as follows:

To the Master Plumbers' Association

of ....

March 15, 1887.

GENTLEMEN: The Essay Committee of the National Association has selected the following subjects for consideration:

1. "Is a trap on main drain of a building a necessity?"

2. "Foot-vents or fresh-air inlets; their location and termination."

3. "In the interest of public health, should the plumbing trade be regulated by legislation?"

4. "How can the apprenticeship system be better regulated?"

5. "Plumbing trade-schools—their objects and who should receive the benefits of this instruction."

6. "Drain, soil, and waste pipes—of what material should they be composed?"

7. "Should a system of payment by the hour be adopted by the plumbing trade?"

8. "Is it necessary to construct a grease-trap or catch-basin on kitchen or pantry-sink wastes before entering main drain of building? If so, how should it be constructed and where located?"

In place of selecting one subject for each association, the committee thought it best to send a copy of the whole eight subjects to each association, with a request to select one or more of them, and report the same to the National Secretary.

The object of the committee in not selecting more subjects for essays is to have several associations write on the same subject, as all may not think alike. Different views brought out in this way will be very interesting and profitable.

James F. Davlin, Isaac Riley, Daniel G. Finnerty, John Crawford, John H. Stevens, Essay Committee.

In commending the work of the Essay Committee to the local associations, we desire to express the hope that they will give the subject matter therein contained their earnest consideration, to the end that such a general interchange of views may be had at our next annual meeting as to enable us to settle definitely many of those questions at present under discussion, and which can be settled by our craft alone, and thus, in the light of that knowledge which comes from experience, one of the primary objects of our National Association is attained—viz.: "Encouraging inventions and improvements in sanitary appliances; fostering an interchange of thought and eliciting and communicating for the benefit of each member the best talent and the result of the experience and ability of all."

Thomas McNeil, Secretary; James Allison, President.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. X.

(Continued from page 404.)

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

TANKS.

22. Has any plan been suggested to avoid using tank-water for drinking and cooking in apartment houses?

That each apartment should have a small independent pump for such purposes.

23. Why should the tank-room be thoroughly ventilated and kept free from vitiated air?

Because water rapidly absorbs foul gases and odors, and makes it dangerous to use.

24. Is there a simple way of proving this?

Yes; a pail of water placed in a newly-painted room will decrease the smell, and, when examined, will be found to have an oily scum on it.

25. What should also be borne in mind in regard to contaminated water?

That tank-water is liable to contamination, and possibly may be used for drinking purposes.

26. Is it advisable to cover tanks?

Yes; but provision should be made for ventilation or aeration.

27. How would you determine the proper size of a tank?

By ascertaining how much would be required for at least 24 hours' supply.

28. Should a tank ever be connected directly with a water-closet?

No.

29. How should a water-closet be supplied?

From a cistern connected with closet.

30. How should the tank overflow be placed?

For tanks on roofs, the overflow may run on roof. For houses where tank is below roof, the overflow should be carried to an open sink properly trapped.

31. What is the use of a tell-tale pipe, and where should it be led?

To indicate when tank is full, and should be led to a sink near pump.

32. What is the advantage of a large pipe between pump and tank?

There is less friction, and therefore pump works more freely and abundantly.

33. What size and weight should the tell-tale pipe be?

It should be at least three-eighths of an inch, and weigh about one pound per foot.

34. What proportion should the overflow-pipe bear to the supply-pipe?

Its area should be about double that of the pump or supply-pipe.

35. How do tanks get dirty?

From the collection of sediment and from water becoming stagnant.

36. What ill effect comes from dirty tanks?

The water is rendered unhealthy and unfit to use, even for washing.

37. Is there any device for letting the engineer in basement of a house know the amount of water in a tank in upper part of house?

Yes; by a float in tank connected with an indicator in cellar which shows exactly the depth of water in the tank.

38. How could this device be used in connection with an engine worked by a gas-stove?

It could be connected with the gas-cock supplying the engine with gas. By means of the chain and pulleys the gas-supply can be cut off when tank is full.

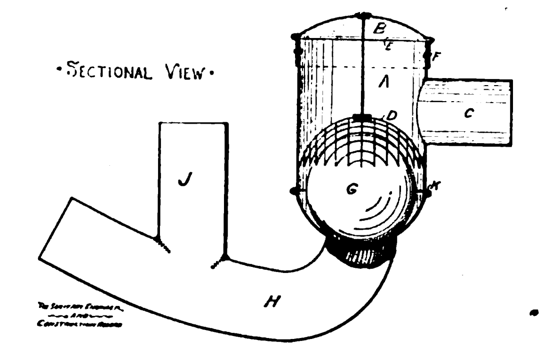
(TO BE CONTINUED.)

Novelties.

Under this heading we propose to describe and illustrate appliance of probable interest to our several classes of readers. Th selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

BALL-TRAP.

THE illustration shows a new trap and strainer for baths and wash-basins. It consists of a cylindrical body A, with removable cover B. This cover carries a rod which sustains a wire screen or strainer D. This strainer covers and restricts the movement of the ball G, which closes the inlet H of the trap. The ball of rubber is weighted so as to sink



lightly to its seat, and at the same time rise under a slight pressure exerted by inflowing waste water. The ball acts as an additional seal, should the water by any means be drawn from the trap, or should back-pressure be met with. As furnished for use, the body A of the trap revolves easily on the base, which is attached to the inlet H. This allows the inlet and outlet pipes to be placed in any position which particular circumstances may require. When the trap is set under its fixture, and the outlet and inlet turned in the proper direction, the body is firmly soldered to the base, and the trap made water-tight. The cover is made removable, being secured by a pin and slot F, to allow lint or any other matter which catches on the screen to be removed. C is the outlet and J the connection for the overflow pipe.

The trap was invented by Mr. Frederick L. Brown, of Scranton, Pa., and is manufactured and sold by Jamieson & McKinney, of Ithaca, N. Y.

THE late Legislature passed a bill abolishing the Water Board of Minneapolis as one of the departments of city government. It is understood that City Engineer Rinker will have exclusive control of the water-works under the new law, with authority to designate a subordinate to exercise practical direction so far as engineering duties go. The financial affairs of the board will be left in the hands of the City Controller.

THE Board of Examiners of the Plumbers' Company of London held an Examination of plumbers, preparatory to registration, on February 19. Practical tests of skill in pipe-bending, joint-making, etc., were included in the examination, and eighty-nine certificates to masters and journeymen were issued.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
March 19........	24.79	19.93	21.79	29.01	28.28	25.67	29.62

E. G. LOVE, Ph.D., *Gas Examiner.*

STREET-LIGHTING IN NEW YORK.

WE have received a copy of the report of the Superintendent of Lamps and Gas of this city for the quarter ending December 31, 1886, together with a summary for the entire year.

The total expenditures of this bureau for the year 1886 for "lamps, gas, and electric-lighting" amounted to $712,488, out of an appropriation of $718,800.

The lighting of the public lamps cost $639,096, which was distributed as follows: gas-lamps, $456,465; electric-lamps, $180,420; naphtha-lamps, $2,211. The gas supplied to public offices cost $36,269.88.

On the 31st of December there were 1,018 miles of gas-mains in the streets of this city, of which 927 miles were on Manhattan Island.

The gas-lamps on Manhattan Island which are supplied by the Consolidated and New York Mutual Companies cost $17.50 each per annum, while those of the Equitable Company cost $12. Beyond the Harlem River, the Central Company is paid $28, and the Northern and Yonkers companies $30 per lamp.

The electric-lamps cost seventy cents each per night, or $255.50 each per annum. The United States Illuminating Co. furnish 363 lamps, and the Brush Electric Illuminating Co., 348. The total aggregate length of streets which were lighted by electric-lights on December 31 was thirty miles, to which must be added about forty-two acres of public parks, etc.

The report contains one very interesting table, in which a comparison is made between the number and cost of the electric-lights now in use and the number and cost of the gas-lamps which were replaced. There are 711 electric-lamps, which have replaced 3,211 gas-lamps, so that each electric-lamp is equal to 4½ gas-lamps. It appears, however, that the 711 electric-lamps cost $125,468 more than would have been paid if the streets had been lighted by the gas-lamps.

To show to what extent the system of electric-lighting would be carried if the Board of Aldermen had their way, we may mention a tabular statement of the report in which is given the streets which the Alderman have requested the Gas Commission to light by electricity, together with the estimated number of electric-lamps required and their cost, and the gas-lamps which would be replaced by the change. If all these substitutions were made it would require 2,123 electric-lamps at a cost of $542,426.50. They would replace 5,385 gas-lamps, and the expense of maintaining the electric-lamps over and above that of the gas-lamps would be $446,299. The total number of gas-lamps on December 31 was 24,194, besides which there were 120 naphtha-lamps and 711 electric-lights, making a total of 25,025.

The report also contains a summary of the weekly photometric reports and the quarterly reports of the Gas Examiner, abstracts of which have appeared in THE SANITARY ENGINEER AND CONSTRUCTION RECORD from time to time. The following figures show the averages for the year of the illuminating power of the gases supplied by the different companies: Consolidated Co., New York Branch, 24.81; Manhattan Branch, 20.03; Metropolitan Branch, 21.49; Municipal Branch, 29.26; Knickerbocker, 23.57; New York Mutual Co., 30.05; Equitable Co., 31.41.

THE Minister of Public Instruction of the French Government has recently submitted to the Academy a series of questions with regard to the precautions which should be taken for the protection of buildings from lightning, particularly in the case of buildings which are roofed with metal. As might have been anticipated, the reply of the Academy was to the effect that all such masses of metal should be carefully connected with the conductors, that for extensive buildings several conductors should be affixed at different points, and that it was above all things necessary to see that the conductors make thoroughly good earth connection.—*Electrician.*

PHILADELPHIA ENGINEERS' CLUB.

AT the meeting on March 15, Mr. S. L. Kneass presented an illustrated description of a new fixed nozzle automatic injector that will restart itself, if from any cause its supply of water or steam be temporarily interrupted. It is especially designed for locomotive service, where its power of adapting itself to varying steam-pressures and its automatic action are especially desirable.

Mr. R. W. Lesley presented illustrated notes upon the manufacture of cement in the United States and the growing demand for high-class mortars.

He said: "When immense buildings of eight, ten, and twelve stories high are run up in a single season the demand for better mortar is making itself felt. In olden times when buildings like the Strasburg Cathedral took centuries to build, lime-mortar was good enough, as the weight was superimposed gradually, allowing the mortar time to harden. This is no longer the case, and the lime-mortar on the inside of thick walls, nearly deprived of air, sets slower than the mortar on the outside where the air reaches, and, as weight is piled on, a settling takes place in the part of the wall where the mortar is still soft. This is due to the fact that lime-mortar sets mainly through the acid of an external element—viz., carbonic acid gas, which it takes up from the atmosphere slowly. Deprive it of air and the setting never takes place. To meet this emergency, experienced architects and engineers are looking to cement not only for use in the moist foundation, but for use in the entire brick and stone work of large buildings when speedy work is desired. Cement-mortar differs from lime-mortar in its setting, in that it sets within itself without the aid of external elements. Lime-mortar is, at best, a mechanical mixture, and in order to make it perfect, a large excess of water has to be used, which, as it oozes out under superimposed weight, adds only another danger to the use of such mortar. Cement-morter, on the other hand, forms by the addition of water a chemical mixture throughout all its parts, and possessing within itself, as already stated, all the elements for its own hardening. This hardening takes place throughout the whole mass almost simultaneously.

"It 'sets' not only at the outside where the formation of the hydro-silicates of lime, alumina, and iron are additionally strengthened by the carbonic acid gas there absorbed by the lime from the atmosphere, but it hardens likewise in the interior where the setting, caused by the formation of hydro-silicates, goes on indefinitely, improved, however, in all cases by moisture. This may be remarked in cement briquettes which at periods of thirty days and over in water show a marked hardening and drying out in the centre and a gradual spreading of the hard centre toward the crust at the surface at longer periods. The simultaneous hardening of the cement-mortar thus enables the builder, without waiting for it to dry out like lime-mortar, to pile upon it immense weights, as there is present no free water uncombined to ooze out and cause a settling or sliding; the true cement, in setting, refusing all water not chemically combined.

"The strength of cement over lime mortar is shown by tests at the Waterveliet, N. Y., Arsenal to be about two to one in favor of the former.

"To meet the demand for better mortars, two classes of cement are on the market. The natural cements, like 'Rosendale,' 'Louisville,' 'Union,' 'Buffalo,' 'Utica,' 'Anchor,' and the artificial Portland cement. The market for both grades has increased greatly within the last five years, but while the output of natural cement has increased to a considerable extent, its growth has been far outstripped by the wonderful advances made in the importation of the foreign Portland cement. This fact shows not only the tendency toward the use of better mortars, but toward the *best* mortars. For just as the Portland cement in Europe has driven out the Roman cement, so here it is only a question of time when the Portland cement will drive out the natural cements, good as these are in this country. The reason for this is clear when the nature of the two cements is considered.

"Natural cement is made by burning in an ordinary draw-kiln hydraulic limestone or cement-rock at a moderate heat, and grinding the calcined product to powder. The result is a product depending for its uniformity upon the uniformity of the rock out of which it is made, and in which the elements of alumina, silica, and lime existing in laminæ or in crystals are not *all* brought in close enough contact to form active combining elements when exposed to fire, and in which, moreover, the low heat of its burning is not sufficient to form aluminate of lime. In other words, it is a product depending for its strength and uniformity upon the ever-varying elements of a natural rock. Portland cement, on the other hand, is an artificial product, chemically proportioned by the proper selection of the materials entering into its composition. These—whether chalk and clay as in England, marl and clay as in Germany, or hydraulic limestones as in this country—are, in every case, reduced to the finest powder by either wet or dry grinding, and this powder moistened merely in the 'dry' process, or in the form of paste in the 'wet' process, becomes practically, either by drying in large tanks or by being molded into bricks, eggs, or other forms, *a new stone*, in which all the elements are brought in close contact and are in perfect chemical proportion. This artificially-made new stone, burnt as it is at high heat in closed kilns, has every element chemically active, and the clinker represents practically, when properly proportioned chemically, a composition of bi-basic silicate of lime and aluminate of lime. This ground clinker is the Portland cement of commerce, a fixed uniform product sold under a warranty of its strength and fineness, and depending upon the controllable elements of skillful manufacture for its character and uniformity. Until lately it has not been manufactured to any very great extent in this country, owing to the fact that most of the cost being *labor* it could be made much cheaper abroad. The great trouble of the wet grinding; the acres of ground devoted to the settling tanks for the creasing, 'slurry' or mix; the long time required for drying the paste; the subsequent carrying of the paste to drying-floors, and its final placing in the kiln, all involved a large outlay for labor, land, and interest, which in this country could not be successfully met to allow competition with the foreign brands.

"To do away with the immense cost of this part of this process was the problem American ingenuity had to solve, and its first efforts in this direction have some years ago been referred to at a meeting of this society. By inventions used by the American Improved Cements Company, and by skillful methods of manufacture at their works at Egypt, Pa., this company announce that these efforts have been carried on to commercial success, and to-day American Portland cement is actually being sold in this country and in England and Cuba. The material used in its manufacture is a hydraulic limestone or cement-rock containing the proper chemical ingredients. The process is briefly as follows: The raw rock is crushed and ground dry. The powder thus formed is run into a mixer, where a small proportion of pitch and water is added. The moistened powder is then passed through a pair of heavy rolls, having matched egg-shaped cavities, which mold it into small eggs, and deliver these latter in front of the kilns, avoiding all handling. These eggs can be used the same day in the kilns if necessary, whereas under the old process the same stage of manufacture required weeks, to say nothing of the immense saving in labor, land, and interest as above stated. The form of the material, its uniformity in denseness, porosity, and size, make it more easily burned, handled, crushed, and ground, and make a saving at every stage of the process, while the addition of the pitch aids the uniform burning, and, moreover, by forming pores, though which the moisture in the eggs escape, prevents them from falling away in the kiln, which they would otherwise do owing to the generation of steam within them, and the formation of a crust on their outer surfaces. This is the point which in the old processes prevented the prompt placing of the wet paste in the kilns, and which is here overcome by the use of a combustible. By this process the foreign brands are fairly met in point of price, and repeated tests by leading authorities here and in Europe show that the quality of the cement made is equal to the foreign Portland cement."

The Secretary presented for Mr. Theodore J. Lewis a paper upon 3-inch *vs.* 4-inch thick steel tires.

The Secretary presented for Mr. A. P. Broomell an illustrated description of the large engines being built to drive the centrifugal pumps for reclaiming the Potomac Flats, Washington, D. C.

The Secretary also presented for Mr. Broomell a copy of an ice-machine, which he had designed with a view of overcoming some of the objectionable features in previous machines.

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

No. VI.

(Continued from page 352.)

OF the sandstones having a siliceous binding material, Potsdam sandstone, which has been used in the recently constructed buildings of Columbia College, and the siliceous triassic sandstone which was the material used in the lower part of the Cathedral at Rodez, are the best examples; and in these no decomposition takes place. Of these sandstones it will be noticed that there are two general varieties, one in which the quartz grains are more or less large and are rounded, but are cemented together by silica, a variety which may be found in any quarry from which brownstone is taken, and is the only variety of that kind of sandstone which should ever be used for building. In the Potsdam sandstone, on the contrary, the grain of the quartz is quite small; its shape, when it can be distinguished at all with a magnifying-glass, is always angular. The stone is porous, but is cemented by silica, so that it appears, on a cursory examination, to be quartzite. This is the best of all building materials, though moldings made of the other variety will last for many years, without suffering any appreciable amount of deterioration. The Potsdam sandstone has been but recently introduced into New York. It is an excellent building material. Almost the only objection to be made to it is that it is difficult to obtain it in large pieces.

The siliceous variety of the ordinary brown sandstone may be seen in any house where brownstone is used, in any large city. It has often been the case, that in examining houses where the decay has gone on to such a degree as to almost make it necessary to take the fronts down, certain of the stones that were composed either of pebbles, or of less coarse grains cemented by quartz, were still so sharp, having undergone no decomposition of any kind, that they could be put back into the building with perfect safety. This is true, not only of the facings of the building, but of the ornamental stone-work around the porticos of the houses. If the selection of only such stones as have a siliceous cement had been made from the quarry—as it undoubtedly was by the masons, who, at the time that the Cathedral of Rodez was built, were a religious order—we should probably have had little experience of the decay of sandstones. Those men selected from the quarries only such stone as they knew from tradition or their own experience was most suitable. It is a curious fact, and a standing monument to their knowledge, ability, skill and conscientious work, that many of the sandstone buildings which they constructed are still standing without serious decay, while those built later on are either on the way to ruin, or are already in ruins.

All of the different kinds of weathering on the brown sandstone can be distinctly seen in Trinity and St. Paul's churchyards. There is every gradation of it, from the stone that shows no trace of ever having been cut, and is just crumbling to sand, to that which stands apparently as fresh as the day it was put up. That careful selection of the stone is all that is required to have it last, is shown by the fact that there is in Trinity churchyard a brownstone headstone, but on both sides, bearing the date of 1681, which still shows the marks of the tools used to cut it. It is but little pitted, though it shows the marks of age. Others in St. Paul's churchyard just as sharp, and showing also the tool marks, bear the dates of 1760, 1766, 1770, 1781, 1787, 1793, while some of 1733,† and a little later, seem to have just started to crack, and many of later date have crumbled to sand. All of these stones stand vertical. That to the Rev. S. Johnston, President of Kings, now Columbia College, erected in 1758, on the north side of the tower, was so defaced that it was recut in 1883. The one to Mr. Faneuil, which lies flat on the north side of the church, which was erected in 1719, has the inscription still sharp. Most of those put up within this century have the dates barely visible. One sharp stone, erected in Trinity churchyard, on the south side of the church, on Broadway, bears the date of 1746, and beside it is one of limestone, bearing the date of 1793, the inscription on which will last but a few years longer. Comparatively few of the stones erected after the commencement of this century are well preserved.

The causes of the decay in all of these stones are the solution of the binding material, and consequent deterioration of the strength of the stone; or, where the stone is weak in some parts and strong in others, as in the case of many of the ferruginous sandstones, the part of the stone unable to bear the pressure yields, throwing the weight upon the rest of the stone, which having too great a pressure upon it also yields, and the stone fails entirely. Where the building material is lime, the cause of the disintegration is the action upon it of the minute quantity of carbonic acid, and sulphurous and other gases, dissolved from the air in the rain-water, which readily attack the surface of the stone. If the moldings are improperly cut, so that the water remains on them for any length of time, or passes through them, it may be that the surfaces of the under sides of the projecting pieces, such as balconies or projecting sills, which are improperly drained, and places where either the snow and ice of winter or the water of ordinary showers may rest, so as to become either absorbed in the stone or to pass directly through it, carrying with them some of the binding material in soluuion, which

* A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

† In St. Michael's churchyard, Charleston, S. C., there is a cypress-wood headboard, erected to the memory of Mary Anne Luten, who died in the year 1740, which is still in good preservation, and likely to last many years.

eventually becomes entirely dissolved, will become either partially or wholly disintegrated. Such is the case with the very thin moldings which form the tops of the windows of the highly-decorated houses built at the time this sandstone was first introduced.

The effect of the small amounts of city gases absorbed by the water in dissolving out the binding material of the stone can be most distinctly seen whereever there has been a leak which has caused a permanent drip over the surface of the stone. Here not only the change of color, but the pitting from the solution can be most distinctly seen. It is as true in nature on a large scale as in the laboratory, that the lime and magnesia is less soluble in concentrated solutions than in diluted ones. The amount of carbonic acid in the water and the air at any time is extremely small, but the accumulation of very minute quantities, acting over a large area for a considerable length of time, has, in many instances, been sufficient to dissolve out the whole of the binding material, leaving little else than a skeleton of sand. Where there are two binding materials, one of which is lime, the solution of the latter leaves the stone porous. When oxide of iron is the binding material, this is easily dissolved out, though not so easily as the carbonate of lime, unless the iron itself has come from the decomposition of pyrites, when it contains sulphur, in which case its oxidation would cause the solution of some of the binding material, which would also be acted on by the organic and mineral acids contained in the city gases. The decomposition of some of the sandstones of the coal formation in Kentucky is both interesting and peculiar. These rocks are of variable texture, being in places coarse and forming conglomerates, while in others they resemble a very uniformly fine sandstone. When this fine-grained rock is first exposed, it is quite hard. It stands up against the weather on all sides except the north. On this side it disintegrates and falls to sand, in irregular caves, often ten or fifteen feet high, forming by its disintegration the only pine lands of the district. This cave-forming takes place horizontally and vertically at the same time, leaving a thin hanging front, which to all appearances from the outside is solid rock. After some time, holes of irregular size form in this front, which eventually breaks down, as does also the overhanging rock, when it can no longer bear the weight above it. In this case the disintegration is caused by weakness from the loose consolidation of the grains of sand.

The decomposition of the sandstones shows itself in several ways. The first and the most general one is by flaking, where large pieces, apparently parallel to the stratification, chip off, to the depth sometimes of a quarter of an inch. When these are examined carefully, they do not always show any trace of following the strata of the stone. This flaking does not take place until most of the binding material has gone, or been entirely dissolved out. Whether this material is of an organic or mineral nature, the depth of the decomposition will determine the point at which it flakes. The least blow, or a hard winter, or the infiltration of water which freezes, or the accidental arrangement of a series of mica plates, will determine the point as well as the moment at which it will fall. Sometimes, when this cause exists only to a small extent, or when there is a cavity in the stone, it will begin to bulge away from the sides, and may even crack out by the infiltration of moisture, when that moisture is caught in the interior and freezes. This frequently takes place over roughly finished surfaces, as the projecting fronts over doorways, which, when the phenomenon commences, sound hollow when struck, and are then entirely at the mercy of the frost, which will eventually break them to pieces. I have frequently seen slabs on the upper parts of stoops, five feet square, which were detached from the underlying stone in this way, in the centre of a larger slab, which remained in this condition for several years, showing no trace of decomposition on the surface, and which were finally detached from it either by an accidental blow or by the heaving of the frost. When such slabs are once broken or cracked, the pieces rapidly flake off. It is asserted by some stonemasons that flaking may be produced by improperly dressing the stone; that where the surface is dressed by the blows of heavy hammers, particularly if a large number of blows are made in regular time by a uniform movement either of machine or hand, the surface of the stone becomes so fatigued that there is a tendency toward the separation of the grains, and that a stone so dressed will eventually laminate. Whether this be true or not, it would only account for a part of the difficulty. Although this method of dressing has been very generally abandoned for the planing and polishing machines, there is no diminution of the lamination of these stones.

I have tried filling the cavities made by fracture out of a laminated surface in such stones with stone putty or cement, but never have been able to keep them from breaking off on horizontal surfaces. I have sometimes been able to hold them in place for a few years with shellac on a vertical surface. That the decomposition has gone beyond the pieces flaked off may be seen by examining the surface of the stone from which the flaking has taken place with a glass, even when the fresh fracture has been exposed for but a short time only. On looking carefully at it, it will be found that the surface is pitted. This pitting on the outside surface is generally taken for hammer marks, but on examining it carefully it will be seen that the stone has become open and that it has changed color. This change of color is owing to the deposit of a certain amount of soot at the bottom of each one of these holes, so that the change is an apparent and not a real one. This pitting not unfrequently extends through the flake to the surface of the stone below. If examined carefully at this stage, it will be observed that the pitting is owing to the fact that the binding material has been dissolved out to a considerable extent. When such stones are examined with the microscope it will generally be found that the pitting, which is all that is at first visible, has been accompanied by a honeycombing of the stone, which appears as if riddled with minute holes when the pitting has gone deep enough and that the binding material, of whatever nature it might have been, has been either partly or wholly removed. This is especially true when it is carbonate of lime, or when there has been any cause of weakness, such as the presence of minerals which have a tendency to assume specific directions. Any cause which will produce an unequal expansion, such as the freezing of the water infiltrated, or the exposure of the surface to a very hot sun, will have a tendency to cause the stone to break off in thin lamellæ, or to flake. Pitting, as it usually occurs in the brownstone of the city, cannot generally be seen by the eye, and can only be observed by a careful examination with a glass. Occasionally a thin flake of the decomposed stone is sufficiently honeycombed to allow the light to pass through the fine pin-holes. Sometimes, however, as in the stone of Castle William, on Governor's Island, it is quite deep, in some cases in rounded, but oftener in elongated holes, which have penetrated the stone a quarter of an inch or more. When the pittings are so large as this the stone does not flake, but falls into sand.

Sometimes the stones do not flake, but simply crumble over the surface and at the sharp edges. This occurs where either the angles have been too sharp for the stone, or where the stone has not been properly undercut, so that the water passing through dissolves out the binding material and leaves nothing to hold it together. This kind of decomposition takes place in the quarry as well as in the structure, and may have taken place to such an extent that the stone is worthless to a very considerable depth. I have known of some cases when it was necessary to strip the sandstone of a quarry for twenty feet before arriving at any sound stone. It is said that in opening new sandstone quarries, the rock for two or three feet can be removed with a pick, and that it is generally necessary to reject the stone for several feet. It is, therefore, not safe to use a stone from a new quarry without first making a complete microscopic examination of it, which should be supplemented by a partially chemical one, to ascertain, first, whether the stone is sound; secondly, whether it contains any material which will be likely to be either decomposed or be absorbed by the action of the elements. With the sandstones that are very porous and have lain in the quarry-bed, the mere freezing of the water absorbed will be sufficient to flake off part of the surface; or, when that does not take place, to crumble the stone considerably.

It was formerly the practice to require by contract that the stone should be exposed to the air for a certain time after being taken from the quarry to season—that is, have the quarry-water dried out of it—and to ascertain whether there was any commencement of decomposition or disintegration in any part of the stone. This was the practice of most of the ancient architects. Sir Christopher Wren required that the stone for St. Paul's Cathedral, in London, should season for two years after it was taken from the quarry before it was put into the building. It is well known that stones with the quarry-water in them are much softer than after exposure. This is particularly true of the soft limestones of Paris, which can be easily cut with chisel and saw and planed with a plane while the quarry-water is in them, but which afterwards become quite hard, so as to very considerably increase the expense of dressing them. It has been frequently remarked that when stones with the quarry-water in them are exposed to the temperature at which the water freezes, they chip much more readily than when, after it has once been dried out, they are exposed to moisture. The explanation which has been given for this is that the quarry-water contains salts in solution, which, on the evaporation of the water, bind the stone together, and thus make it stronger. Whether this is so or not, it was well known to the ancients, and it has been shown by modern experience that a tempered stone lasts longer than a fresh one, and the fact merits the attention of builders. It often happens that decomposition may have gone on in certain localities to the depth of three to four inches without its being perceptible on the surface. Where iron pyrites, in any shape in which it can decompose, is present, this will act upon the various kinds of binding material, and cause the stone to disintegrate.

The causes of decay then are: first, improper selection of the stones in the quarry; almost every sandstone quarry contains poor stone, as well as that which will last for a great length of time, and this can always be distinguished because it is highly siliceous, and contains no traces of mica, and but little material soluble in acids. The presence of mica is essentially bad because it shows a probable tendency to lamination in the stone. Where the stone would otherwise be good, the improper cutting of moldings, and especially the want of undercutting of projecting moldings, so that the water will be shed instead of running up over or down through, is the most fruitful cause of decomposition in the buildings of the present day. Where the edges are very sharp, there will always be a tendency, by capillary attraction, for the water to run up until it meets some point so ascending that it cannot follow up, and from here it will drip without passing through the stone. Where the surfaces are flat, crumbling or lamination will take place; where they are thin, so that the water will pass through them, the stones will crumble and flake; and where there are large surfaces immediately under projecting moldings, in such a condition that the water will flow up over the molding, and then slowly down the face, lamination will take place. It is a remarkable fact, in looking over buildings that have undergone this decomposition, that the greater part of it will be found within a comparatively short distance from the ground—generally within ten feet. From this point it gradually diminishes up to about fifty feet, where it ceases entirely, unless there is some action of sulphurous gases, or the acid or alkaline gases from the combustion of wood or coal, or from manufactories, coming in contact with the stone. In all the buildings that I have had occasion to examine, beyond 100 feet there is not only no decomposition, but the stone is harder than it appears to have been originally. The same stone which would last almost indefinitely when put into a building in the open country, with no other buildings near it, would be subject to decay in the city. The present mania for high buildings, if it had not been stopped by law, would have increased this decomposition, and would have greatly raised the maximum height to which it would reach.

The stone of which Trinity Church is built is a red sandstone, which has always been supposed to be homogeneous, and, until the decay which has become manifest within a few years, has always been supposed to be one of the stones that would resist the action of the weather. The investigation which has been made,* has shown not only that there are different kinds of stone used in the building, but that none of the varieties are, strictly speaking, homogeneous; for, instead of being composed entirely of quartz grains, united by a cement, they contain not less than twenty-eight different varieties of minerals, embracing twenty-five species, some of which are quite susceptible of decomposition, and many of which have begun to decay in places, and this process is still going on. The following is the list of the minerals found in the sandstone of Trinity Church:

Quartz,	Biotite,	Calcite,
Amphibole,	Hydro-biotite,	Dolomite,
Epidote,	Sericite,	Magnetite,
Garnet,	Margarodite,	Hematite.
Oligoclase,	Fibrolite,	Limonite,
Orthoclase,	Brown tourmaline,	Gothite,
Microcline,	Green tourmaline,	Pyrolusite,
Kaolin,	Indicolite,	Rutile,
Muscovite,	Cyanite,	Asphalt.
	Apatite,	

In addition to these, there is a considerable quantity of opacite, a name given by Vogelsang to the black opaque grains and scales which so frequently occur in rocks, and which cannot be identified with magnetite, menaccanite or any other mineral. What is more remarkable in this enumeration of species is the complete absence of pyrites. All of this stone contains a considerable quantity of material easily soluble in acids, most of it effervescing, a certain portion of it going into solution with the greatest ease. If the stone had been properly selected at the time of the building of the church, or if the moldings had been so constructed as to shed water, I think there would have been but little decomposition at this time, but without some protection it must eventually have taken place.

The depth and kind of decomposition differ in each variety of stone, but all have undergone more or less of it, and wherever any of the stone lies below a projecting piece, the decomposition has gone on to a very considerable extent. After selecting the pieces that were more or less affected, I succeeded in getting a piece of the stone which had been lying exposed to the weather until within four or five years, and had then been accidentally buried. I had it dug up and left exposed to the air for some time, and then carried to the cellar of the church, where it was dried at a temperature of about 60° for two or three months before the specimens for examination were taken from it.

The decomposition shows itself in these stones in three different ways: first, by deep pitting and falling out of grains of the minerals which compose the stone; second, by lamination; and third, by crumbling to powder. The way in which each one of these is effected depends upon the position of the stone. The pitting is quite irregular, and is due to the removal of the cementing material from the surface; and where this has been done by the action of the weather, there seems to have been a deposit of sooty material at the bottom of the depression which has slightly changed the color of the stone, so that the outside is of a different tint from the inside. The cause of this is not shown until the stone is examined with a microscope of high power. On treating such a stone as this with acid, generally no effervescence takes place, and very little of it is soluble. The same is true, but to a less extent, where the rock has flaked. The flaking does not appear to be owing to the fact that the stone has been used in a different position from that which it held in its quarry-bed, though in many places it has evidently not been placed in its natural position; nor to the fact that the stone is laminated, owing to the presence of large quantities of mica; but it is owing to the absorption of the cementing material by atmospheric influence. It is also to be observed that there are in many sandstones which are used for building in this city, organic materials which act as the cement, and are easily decomposed by exposure to the weather. Stone of this kind, except to a very limited extent, does not seem to have been used in the walls of Trinity Church, though it is extremely common in other parts of the city. It can only be kept from complete disintegration by filling the pores of the stone with some substance which will prevent further encroachments of the weather, which must be renewed from time to time as it is decomposed or dissolved out. By the original agreement, the stone of which the church was built was to be taken from a single quarry, which had been determined by observation to give a strong stone, but this agreement, like that made for the stone of the House of Commons, in London, was not adhered to. The different varieties of stone used in the building are:

* The microscopic examination of the specimens taken from Trinity Church was made by Dr. A. A. Julien, of the School of Mines.

First—Fine-grained, lamellar reddish-gray. Of this variety there were fifteen specimens.

Second—Fine-grained reddish-brown. Of this variety there were six specimens.

Third—Fine-grained light gray. Of this variety there were six specimens.

Fourth—Coarse yellowish-gray. Of this variety there three specimens.

While the varieties examined were most of them weathered, specimens of these varieties are easily distinguishable in the unaltered stones of the building itself. The stone was, for the most part, of the same origin, having had in quarry a calcareous cement. It does not appear that any large quantity of this stone would have endured exposure in the quarry or in the building for any great number of years without being affected. None of those which had a siliceous cement appear to have been decomposed. There are two types of the first variety of stone, distinguished as A and B. Both of these were taken from the piece that had not been exposed in the building. The type A was coarsely laminated and contained the following minerals: Quartz in very irregular grains, most of them rounded, some of them quite spherical, filled with minute bubbles either in motion or quiet, varying in color from smoky, through white to red; orthoclase, plagioclase, probably oligoclase, and microcline distinctly cleavable. These were the prevalent minerals. Magnetite and menaccanite in grains of varying size are quite evenly distributed. Biotite, hydro-biotite, muscovite and margarodite are quite regularly scattered through the rock; epidote in small particles, rarely in prisms; green and blue tourmaline in occasional grains; iron ochre and garnet in very small grains, and sericite in minute bunches around and between the grains of quartz and feldspar, are also found. Of all the minerals the micas are those which have undergone the most decomposition, the hydrated varieties appearing everywhere, and these frequently having become opaque from still further decay. The rock gave a lively effervescence with citric acid, showing the presence of calcite; apatite was also present in small quantities

The composition was determined as—

Quartz	57 parts.
Feldspar	31 "
Fine-grained minerals	12 "
	100

The rock was slightly altered, as were also the minerals that compose it. To give a fair idea of the amount of decomposition, the grains of about the same size were counted and classified according as they were more or less affected.

	Clear.	Slightly cloudy.	Very cloudy or opaque.
Orthoclase	6	22	16
Oligoclase	4	1	..
Microcline	1	..	..
Hydro-biotite	14	14	12

It thus appears that the feldspars were the most decomposed.

The second variety of the stone, B, which had not been put into the building, had lain on the ground in the churchyard exposed to the elements for about thirty years. One part had been acted on by the weather, and was of lighter color than the rest, owing to pitting. Here the dropping out of grains of quartz and feldspar is distinctly visible, but all parts of the stone effervesced with citric acid. The specimen contained about the same quantity of quartz and feldspar as No. 1. Hydro-biotite, sericite, margarodite, and amphibole are in elongated and crushed fragments; kyanite, blue tourmaline, hematite, magnetite, limonite, and calcite were also found.

The way the alteration of the minerals which compose the rock had taken place is given below:

	Clear.	Cloudy.	Very cloudy.
Orthoclase	9	22	4
Oligoclase	11	2	..
Microcline	1	1	..
Hydro-biotite	3	1	2

The weathered part of this variety is deeply pitted, but there does not appear to be any appreciable widening of the distances between the grains, but the rock is honeycombed by the deeper of the pits going through the flaking; the calcite was entirely gone, no effervesence taking place in citric acid. The minerals themselves do not seem to have undergone any decomposition since they became incorporated in the stone.

Of the scond variety there were two unaltered specimens, both of which were taken from the inside of the tower high up in the steeple. It contains much more ochre than the other varieties. The minerals composing it are quartz and feldspar as before, brown tourmaline, sericite, margarodite, hydro-biotite, garnet, epidote, and magnetite. It does not efferversce.

The proportion of the ingredients contained in the stone was:

Quartz	41
Feldspar	35
Cement	24

All the crusts are deeply pitted and honeycombed.

The third variety is fine grained and indistinctly lamellar. The fresh specimen was taken high up from the inside of the tower. It effervesces rapidly with citric acid. The most prominent mineral is quartz, which is quite clear; the accompanying minerals are amphibole, garnet, margarodite, hydro-biotite, brown tourmaline, and sericite. There is but little plagioclase. The following proportions of these minerals were found in three specimens:

	1.	2.	3.
Quartz	53	61	51
Orthoclase	22	17	39.5
Hydro-biotite	..	2	0.5
Cement	25	20	8.5
	100	100	99.5

The feldspar is whitish, the cloudiness being caused by a great abundance of microlites generally arranged in parallel planes about normal to the direction of easiest cleavage of the feldspar. Between these changes there is a slight transparent film of sericite which polarizes feebly. The mineral is probably the result of the commencement of the alteration of the feldspar, but in some of the grains the decomposition has not progressed further, while in others its progress is shown by the innumerable very small microlites which are quite colorless, but give a milky appearance to the grains where they occur. They are probably both sericite and epidote. The hydro-biotite is transparent green in the centre, and opaque brown on the edges, showing a commencement of decomposition. The other minerals, margarodite, sericite, epidote, tourmaline, iron ochre, do not show anything peculiar. Where the specimen is not decomposed it is close-grained without interstices; when it is weathered it is honeycombed.

(To be continued.)

STATISTICAL TABLES OF AMERICAN WATER-WORKS.*

We have received a copy of the third edition of "Statistical Tables of American Water-Works," which gives a list of the towns which had a public water-supply in 1886. From this publication we learn that 1,402 towns are supplied with water-works, 544 of which are controlled by public authorities, 675 by private corporations, the ownership of 183 works being unknown. Considering that the author has had to rely upon the voluntary giving of information we think he has succeeded in collecting a large amount and presenting it in such a shape as to make the work valuable for reference to any one interested in the construction and management of water-works. So long as a large number of water-works are built and run by private enterprise, it will doubtless be difficult to give in many instances definite information on many of the points dealt with in a statistical book of this character. So far as it has been possible to secure replies to requests for the data, information is given under the following heads: Date of building works, ownership, source of supply, mode of supply, cost, debt, miles of pipe laid, number of taps, meters and hydrants in use, daily consumption, pressure, annual expense and revenue, kinds of pipe for mains and services. The book has been furnished free to parties giving information and is for sale to the general public, by the publishers or by the compiler, 13 William Street, New York City.

PITTSBURG ENGINEERS' SOCIETY.

The Pittsburg Society of Civil Engineers met on March 15, and adopted resolutions of regret at the death of Captain James B. Eads. A paper was read by Mr. Thatcher on the specifications of the Keystone Bridge Company which provoked a lengthy discussion. Colonel J. P. Roberts read a paper on the city's high and low-water lines, pointing out the difficulty of determining either. He proposed the adoption of a system for the determination of these lines up the Monongahela to McKeesport, up the Allegheny to Hulton and down the Ohio to Sewickley. It was decided to appoint a committee of seven to lay the matter before Colonel W. E. Merrill, of the United States Engineers, the city authorities, the Chamber of Commerce and the Coal Exchange, to report back any modifications, or improvements which it may deem advisable.

ST. LOUIS ENGINEERS' CLUB.

The club met March 16, President Potter in the chair. The Executive Committee reported, recommending George W. Dudley for membership. He was balloted for and elected.

The President made the formal announcement of the death of Captain James B. Eads, suggesting appropriate action by the club.

On motion the President was directed to appoint a committee of three to draw up suitable resolutions. Messrs. McMath, Moore, and Holman were appointed such committee. On vote it was decided that the club attend the funeral in a body.

The President announced the receipt from the Mississippi River Commission of a map of the alluvial basin of the Mississippi River from the St. Francis basin south.

Mr. Carl Gayler then read a paper on "Anchorage of Suspension Bridges," describing the common practice, and making some criticisms; also suggesting certain improvements, as adopted in the city's practice. The paper was discussed by Messrs. Johnson, Frith, Holden, Seddon, Macklind, Moore.

TESTING WATER-METERS.

The Boston Aldermen have passed an order relating to the competitive tests of water-meters, requesting the Water Board to subject the various water-meters submitted to a service covering a period of twelve consecutive months, as follows: Three months of that time to be a test upon high service of not less than eighty pounds pressure to the square inch. Three months to be a test upon a service of not less than forty pounds pressure to the square inch. Three months to be a test upon a service of not less than twenty-five pounds pressure to the square inch, and a final test of three months' service in buildings connected to service-pipes.

The concerns who have entered for the public test of water-meters, as requested by the Water Board, are: Balance Valve, Spooner, Pierce & Freeman, Hersey, G. W. Pierce, Continental, Star, and Hood, all of Boston; Barron, of Salem; Terry, of Hartford, Conn.; Union, of Worcester; Thompson, of New York City; Tuerk, of Syracuse, N. Y.; Crown, of New York; Wood, of Cleveland, O.; Desper, of Worcester; and Frost, of Manchester, Eng.

GAS-STOVE COOKING.

Miss Corson lectures this afternoon, under the auspices of the American Meter Company, on "Cooking with Gas-Stoves." The hour is 2:30 P. M.; the place, the Metropolitan Opera House. Tickets may be obtained at Messrs. Grady & McKeever's Picture Store, No. 719 Sixth Avenue, or at the office of the American Meter Company, 223 Sixth Avenue.

The Executive Council of Machine Constructors had a meeting in Philadelphia last Saturday, and decided to hold a convention in Washington next June.

PERSONAL.

A memorial meeting in honor of the late James B. Eads was held last week at the Merchants' Exchange, in St. Louis. Business was suspended during the meeting, which was largely attended. The floors and galleries were crowded. Resolutions eulogizing the deceased and expressing sympathy for the bereaved family were presented, and, after remarks upon his life and character by many prominent citizens, were adopted.

Mr. Richard M. Hunt has been appointed architect of the new Naval Observatory Building at Washington. The total cost of the observatory will be $400,000.

Professor William R. Ware has been retained as professional adviser to the syndicate who propose to institute an architectural competition for plans for the new buildings for the Madison Square Garden site.

James T. McGauran has been appointed Chief Engineer of the Boulevard improvement, which the Hudson County, N. J., Board of Chosen Freeholders is going to carry out.

J. McDonnell, architect, formerly of Green Bay, Wis., has removed to Omaha, Neb., and opened his office.

Colonel William H. Stevenson has been elected Vice-President of the Housatonic Railroad. He is President of the New York, Rutland and Montreal Railroad.

George A. Kimball, who has been City Engineer at Somerville, Mass., for eleven years has resigned, and will make a specialty of water-supply and sewerage.

* Statistical Tables of American Water-Works. Compiled from special returns by J. J. R. Croes., M. Am. Soc. C. E., M. Inst. C. E., for *Engineering News* Publishing Co. New York. 1887.

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

AMONG THE ARCHITECTS.

We report the following work in offices of New York architects:

Douglaston, L.I.—Railroad Station; frame; Queen Anne structure; dimensions 25x50; building to contain waiting rooms and offices on first floor, and living apartments above; cost, $4,000; Edward L. Angell, architect.

Princeton, N. J.—New Art Museum for Princeton College; dimensions 140x65; outside construction of Tiffany brick and Trenton brownstone, with tile roof, fire-proof throughout, with iron staircases and hard wood interior, in Romanesque style; cost, $100,000; A. Page Brown, architect.

Princeton, N. J.—Biological Laboratory, to be built as a memorial for the class of 1877, of Princeton College; dimensions 30x65; outside of Tiffany brick, and tile roof; cost, $12,000; A. Page Brown, architect.

Weatherly, Pa.—Stone church; Episcopalian; for the Rev. Lewis C. Washburn's congregation; dimensions 28x60; outside of local stone and interior finishings of hard wood, with open oak timber ceiling and trussed; style, early English Gothic; erected by day's work; Charles P. H. Gilbert, architect.

West Brighton, S. I.—Boat-house for the Staten Island Athletic Club; dimensions, 60x80; Queen Anne; outside construction, part shingles and part plain, with a shingled roof; the building will be surrounded by a spacious piazza and surmounted with a circular tower; Edward Sargent, architect.

Seabright, S. I.—Addition to the residence of Mr. Wheeler H. Peakham; Edward Sargent, architect.

Palamana, Westchester County, N. Y.—Club-house for the Mana Club, of Palamana; dimensions, 55x63; frame structure; finished plain outside, with hard wood interior, yellow pine floors, walls and ceilings, billiard-room, and bowling-alleys included; F. Carles Merry, architect.

Toledo, O.—Residence for Mr. W. H. Swain, of Toledo, dimensions, 45x55; exterior of brick, stone, and terra-cotta; interior finishings of first floor of hard wood, the remainder plain; F. Carles Merry, architect.

New York City—Club-house for the New York Maennerchor, north side 56th Street, 80 feet east of Third Avenue; dimensions, 80x100; four-story and basement brick exterior and plain inside finishings, with fire-proof stairs. The building will contain a ball room, parlors, dressing rooms, restaurant, and bowling alley; cost, $60,000; Weber & Drosser, architects.

Kreischerville, Staten Island.—Residence for Mr. C. C. Kreischer, of Kreischerville; Queen Anne structure, two-story and basement; dimensions, 40x40; plain interior finishings; Weber & Drosser, architects.

Passaic, N. J.—Residence for Mr. James Swan, of Passaic; dimensions, 48x66; Queen Anne style, with hard wood interior, and outside shingled; cost, $10,000; Samuel B. Reed, architect.

Passaic, N. J.—Residence for Mr. Arthur Swan, of Passaic; dimensions, 35x40; Queen Anne style, with hard wood interior, and outside shingled; cost, $7,000; Samuel B. Reed, architect.

NEW YORK CITY.

61-65 Clinton st, 2 6-story br flats and stores; total cost, $38,000; o, Jane N Cusick; a, Chas Rentz.

142 W 10th st, 4-story br dwell; cost, $12,000; o, L J Callanan, 68 W 11th st; a, Thom & Wilson; b, not selected.

242-244 W 28th st, 6-story br brewery; cost, $50,000; o, M Groh's Sons, on premises; a, Lederle & Co; m, J Vix & Son.

136-140 W 23d st, 5-story iron, br and st bldg; cost, $62,500; o, B Fischer, 116 W 23d st; a, Thom & Wilson; b, not selected.

Pleasant av, e s, 29.6 n 116th st, 2 5-story br ten; cost, ea, $14,000; o and m, John Walker, 233 E 113th st; a, J H Valentine.

116th st, n s, 73 e Pleasant av, 5-story br ten; cost, $12,000; o, m and a, same as last.

NEW YORK CITY.—Continued.

82d st, n e cor 1st av and 83d sts, s e cor 1st av, 2 5-story br and st ten; cost, ea, $20,000; o and b, F A Seitz, 315 E 42d st; a, J M Dunn.

1st av, e s, 27 n 82d st, 6 5-story b s ten; cost, ea, $14,000; o, a and b, same as last.

44th st, n s, 225 w 8th av, 2 5-story b s ten; cost, ea, $20,000; o and b, Abram Quackenbush, 313-315 W 37th st; a, M V B Ferdon.

226-228 E 36th st, 2 5-story br dwell; cost, ea, $15,000; o, P T O'Brien, 110 E 56th st; a, R M Hunt.

82d st, n s, 80 e 1st av, 5-story br and b s ten; cost, $15,000; o, a and b, same as last.

83d st, s s, 80 e 1st av, 5-story blue st ten, 26x65, tin roof; cost, $15,000; o, a, and b, same as last.

3d av, n w cor 96th st, 4 5-story br ten; cost, $25,000; o, F J Schnugg, 8 E 85th st; a, Julius Kastner.

3d av, w s, 25.11 n 96th st, 4 5-story br ten; cost, ea, $18,000; o and a, same as last.

4th av, n w cor 116th st, 2 5-story br ten; cost, corner $22,000, others $17,000; o, Ferdinand Kurzman, 119 E 65th st; a, J F Burrows.

94th st, n s, 275 w 8th av, 2 4-story and basement br and st dwell; cost, ea, $9,000; o, Jessie Reynolds, 108 W 47th st; a, W H Smith; b, not selected.

9th av, n w cor 104th st, 3 5-story br and b s flats; total cost, 78,000; o, J H Edelmeyer, 117 W 71st st, and W C Morgan, 703 9th av; a, Geo B Pelham.

122d st, s e cor 7th av, 5-story br and b s apart-house; cost, $30,000; o, Goldsmith Bros, 5-7 White st; a, T E Thomson.

117th st, s s, 200 e 8th av, 4 5-story br ten; cost, ea, $16,000; o, E J Yondale, 264 W 123d st; a, J H Valentine.

115 Manhattan st, 5-story br dwell; cost, $20,000; o, Mrs Margaret Becker, on premises; a, Schneider & Herter.

126th st, n s, 100 e 8th av, 5-story br and b s apart-house; cost, $15,000; o, M T McCormick, 296 W 126th st; a, T E Thomson.

10th av, s w cor 146th st, 5-story br ten; cost, $22,000; o, a and b, W Fernschild & Son, 2183 4th av.

3195 3d av, 1 2½-story br railroad station; cost, $10,000; o, Suburban Rapid Transit Co, 40 Wall st; a, A Namur.

750 Ninth av, br flat and store; cost, $22,000; o, F Bodenback; a, F Minuth.

752 Ninth av, br flat and store; cost, $22,000; o, Chas Gahren; a, F Minuth.

W s 7th av, 133 ft e 134th st, ten and stores; cost, $168,000, all; o, Walter S Price; a, Cleverdon & Putzel.

S s 90th st, 82 ft w of Park av, 6 br dwells; cost, $72,000, all; o, Walter Reid; a, A B Ogden & Son.

145-147 Madison st, 2 br flats and stores; cost, $36,000 all; o, Chas Lockman; a, Wm Graul.

85 Ludlow st, br flat and store, $18,000 all; o, Engel Bros; a, Wm Graul.

408 W 37th st, br flat; cost, $20,000; o, Alex Moore; a, Keister & Wallis.

S s 82d st, 325 ft w of 9th av, 2 br dwells; cost, $40,000 all; o, Nathan W Riker; a, Lamb & Rich.

S s 43d st, 175 ft e of 8th av, br flat; cost, $18,000; o, P H Dugro; a, Chas T Mott.

N w corner Lincoln av and 138th st, ten and store; cost, $10,000; o, J Shepherd; a, Jas M Dunn.

S s 141st st, 150 w of 8th av, 6 br dwell; cost, $54,000 all; o, Anthony McReynolds; a, W H Bryan.

67 Pitt st, br flat and store; cost, $15,000; o, Owen McGinnis; a, J Boekel & Son.

N e Mott av and 149th street, 6 br dwells; cost, $36,000; o, Thomas W Brinton; a, G Van Cleve.

425-431 W 24th st, 4 br flats; cost, $80,000 all; o, Chas Ruspert; a, M Louis Ungrich.

14 Jones st, br flat; cost, $18,000; o, J & S Donnan; a, Chas Rentz.

115 Lewis st, br flat and store; cost, $18,000; o, Meyer Cohen; a, Chas Rentz.

N s 64th st, 150 ft e of 10th av, 6 br flats and stores; cost, $70,000 all; o, H W Smith a, Andrew Spence.

N s 103d st, 382 ft e of 10th av, 7 br dwells; cost, $105,000 all; o, Geo S Miller; a, Ralph S Townsend.

NEW YORK CITY.—Continued.

256-262 W 43d st, 3 br flats; cost, $70,000 all; o, James J Potter; a, Babcock & McAvoy.

N e cor 7th av and 135th st, br flat; cost, $40,000; o, William Whitehead; a, Berg & Clark.

N s 82d st, 100 ft w of West End av, 5 br dwells; cost, $75,000 all; o, Charles J Berg and others; a, Berg & Clark.

101 Forsyth st, br flat; cost, $18,000; o, Herman Scherman; a, J Boekel & Son.

N w cor 10th av and 126th st, 3 br flats; cost, $75,000; o, Dennis J. Dwyer; o, John H Friend.

89 W 3d st, br dwell; cost, $16,000; o, D S McElroy; a, G W DaCunha.

111-113 E 119th st, 2 tens; cost, $28,000 all; o, P J Mathews; a, A B Ogden & Son.

194 Madison st, br flat; cost, $20,000; o, Feehan & Hammer; a, A B Ogden & Son.

N e cor 10th av and 93d st, 4 br flats and stores; cost, $120,000 all; o, Michael Steinhard; a, George B Pelham.

E s 10th av, 73 ft n of 95th, br flat; cost, $36,000; o, David Christie; a, F A Minuth.

S e cor 10th av and 95th st, br flat; cost, $30,000; o, David Christie; a, F A Minuth.

N s 95th st, 40 ft e of 10 av, 3 br flats; cost, $60,000 all; o, David Christie; a, F A Minuth.

S s 54th, 100 ft w 7th av, br flat; cost, $26,000; o, Sam McMillan; a, F A Minuth.

363-369 w 52d, 4 br flats; cost, $76,000 all; o, Wm Rankin; a, Keister & Wallis.

S s 111th, 75 ft w Madison av, 4 br flats; cost, $64,000. all; a, Healy & Handwerk; a, Bert Walther.

N e cor 184th and Bainbridge av, 10 frame dwells; cost, $25,000 all; o and a, S P Saxe.

N e cor Madison av and 84th, br flat; cost, $45,000; o and a, Robert B Lynch.

140th, near Willis av, 50 br dwells; cost, $225,000 all; o, Wm O Gorman and H Slensberg; a, W O Gorman.

N s 122d, 225 ft w of Pleasant av, 2 br flats; cost, $40,000 all; a, Babcock & McAvoy.

78 Suffolk, br flat and store; cost, $20,000; o, Kottowsky & Levy; a, Wm Graul.

80 Suffolk, br flat and store; cost, $16,000; o and a, as above.

S s 58th, 325 ft e 10th av, 2 br flats; cost, $40,000 all; o, John Curry; a, M V B Ferdon.

N e cor Hester and Eldredge, br ten; cost, $14,000; o, S E Hinman; a, J H Valentine.

W s 1st av, 503 ft n 119th, 2 br tens and stores; cost, $25,000 all; o and a, B W Warner.

S s 72d, 113 ft e 1st av, 12 br flats; cost, $204,000 all; o, J V & S J Donvan; a, Geo M Walgrove.

ALTERATIONS, NEW YORK.

57th st, n s, 100 e Madison av, building to be raised; cost, $19,000; o, Madison Avenue Reformed Church, on premises; a, W B Tubby; m, Alexander Brown; c, W A Hankinson.

37 Av A, 4-story blue st extension, 15.11x20, tin roof, also other alterations; cost, $8,000; o, Mrs C Springer, 39 Av A; a, C Rentz; b, P Schaeffler.

166-170 E 60th st, 3-story br extension; cost, $50,000; o, Bloomingdale Bros, cor 3d av and 59th st; a, A Buchman.

27-31 Rose st, br workshop; cost, $11,600; o, Jas T Preston; a, John D Munir.

622-624 Broadway, br store; cost, $13,000; o, Jac Rothschild; a, not stated.

105 E 40th st, br dwell; cost, $6,000, o, J Bryant Lindley; a, Renwick, Aspinwall & Russell.

S w cor Park Place and Church st, br office building; cost, $10,000; o, Met Life Ins Co; a, N Le Brun & Son.

161-163 6th av, 2 br dwells; cost, $10,000 all; o, est of W C Rhinelander; a, Chas Rentz.

N w cor 30th st and 8th av, br dwell and store; cost, $8,500; o, Felix Donnelly; a, Jas M Dunn.

BROOKLYN.

Frost st, n w cor Leonard st, 2-story br lithographic establishment, 50x100, tin roof, brick cornice; cost, $9,000; o, Henry A Smith, 460 W 44th st, New York; a, G W Hill.

N s S 8th st, 50 w Bedford av, br dwell and store; cost, $11,000; o, O L Fedden; a, E F Gaylor.

S e cor Arlington Place and Macon st, 4 br dwells; total cost, $28,000; o, Horace Russell; a, Geo P Chappell.

(Continued on page 437.)

New Advertisements.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 18. PUBLISHED EVERY SATURDAY.

NEW YORK, APRIL 2, 1887.
LONDON, APRIL 16, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA.
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

THE WATER-SUPPLY OF SYRACUSE, N. Y.

IN July last the Common Council of the city of Syracuse requested the State Board of Health of New York to have a sanitary examination made of several proposed sources of water-supply for the city, and appropriated money to pay for the work. The State Board of Health employed Professor James T. Gardiner to make the investigation, and his report, presented to the board March 10, 1887, is printed in full in the *Evening Herald* of Syracuse for March 11.

The report is a very long one, occupying over thirteen columns of fine type, but the *Herald* has done well and wisely to publish it in full, for it is an interesting and instructive paper to any one, and must be especially so to the citizens of Syracuse. His conclusions may be stated briefly as being in favor of the Salmon River as a source of supply; opposed to Oneida Lake as a source of supply, because it cannot be protected from possible contamination, and that there are no sanitary objections to the proposed Cardiff reservoir. He also thinks that there is reasonable ground for objection to the present water-supply of the city on account of its hardness and of possible contamination.

The details upon which these conclusions are based are mainly of local interest and can only be fully understood by those who are familiar with the topography of the vicinity. Granting the facts as stated, the conclusions with regard to the Salmon River and the Cardiff reservoir are correct. It would be desirable, however, to have fully identified the peculiar red algæ to which Professor Gardiner attributes the dark mahogany color of the water in the Salmon River, and to know something of its life-history before accepting this stream as a source of supply. It is not probable that this algæ would ever be a source of danger, but it may at times give annoyance by producing an unpleasant taste or odor.

As regards Oneida Lake, the danger of its contamination, and the impossibility of obtaining a pure supply from it, seems a little overstated, although it is certainly not a specially desirable source of supply. In speaking of the danger of its pollution Professor Gardiner makes a statement which, if correct, would be one of the most remarkable discoveries in bacteriology. Speaking of deposits of sawdust in a certain mill-pond he says: "It is probable, therefore, that the typhoid germ has become implanted in this sawdust shallow, where it maintains its existence from year to year. * * * It seems beyond question that a bed of typhoid fever has been growing for a number of years in a deposit of decaying sawdust in a mill-pond on Fish Creek." If Professor Gardiner was as familiar with bacteriology as he is with surveys, he would never have made that statement from the data which he gives. If the typhoid germ is growing in the sawdust, as Professor Gardiner supposes, its isolation and identification by culture methods would probably not be difficult. Taken as a whole the report is a very good educational document, and will serve to give those not familiar with the subject some idea of the variety and extent of the points which must be considered by the sanitary engineer in deciding on the future water-supply of a large city.

A NEW FUNCTION FOR BOARDS OF HEALTH.

THE business of a Board of Health is ordinarily supposed to be that of guarding against preventable causes of disease and death in its own community.

Occasionally a health board or a health officer thinks it best to defend the character of its city or town as to its sanitary condition, healthfulness, freedom from malaria or small-pox, or yellow fever, etc., etc., and prepare certificates and reports for the daily press for that purpose, but this is not a common performance, nor have the results of it heretofore been such as to encourage this form of sanitary effort. Human nature is so perverse that the mere fact that a sanitary official has thought it necessary to try to prove that his town is a healthy one is apt to be considered as indicating precisely the reverse of what he is trying to prove.

We have now, however, before us a pamphlet issued by the Board of Health of the town and village of Plattsburg, N. Y., in which they present a memorial to the Legislature in favor of a new State Asylum for the Insane in the vicinity of Plattsburg, setting forth the advantages as to water-supply, sewerage, and general healthfulness which this town presents, and objecting to the location of the institution near Ogdensburg for sanitary and commercial reasons. It is now, of course, in order for the Board of Health of Ogdensburg to publish a pamphlet showing that it is more healthy than Plattsburg, that the water-supply of the latter place is open to criticism, that its sewers are not constructed in accordance with scientific principles, etc.

It is easy to see that this opens a wide field for activity on the part of local boards of health.

We have always urged that the commercial interests of a place are closely connected with its sanitary condition, and when this is made practical use of to secure the location of State or national institutions, it will not be long before it will become a special feature in memorials. What an insight we shall gain as to the sanitary condition of competing localities when each proceeds to inspect and criticise its opponents! What a demand there will be for accurate statistics, for reliable sanitary surveys, etc.! What an interesting document a report on the sewerage and water-supply of Newport, prepared by the Board of Health of Long Branch, or Atlantic City, will be! We await, with great interest, further developments in this line of sanitary labor.

THE NEW TENEMENT-HOUSE ACT FOR NEW YORK.

THE Tenement-House Act, which Governor Hill has approved with a memorandum that it did not go quite far enough in certain particulars, we hope to comment on more at length when we receive the complete copy of the bill as passed, the original copy having been somewhat amended. There are several clauses which we think are a step forward, and which will help the New York Health Board in dealing with this great municipal problem. Not a little credit is due for the passage of this act to Mr. Charles F. Wingate, who enlisted the *Morning Journal* in the work, and has been acting as its Tenement-House Commissioner, besides using his connection with the Labor Party to good purpose, in making it appear to the politicians at

Albany that this was a labor movement, and that it was unsafe to listen to the appeals of the tenement-house owners, who prefer to find profit in maintaining nuisances, and consequently opposed such legislation. Indeed, if it had not been cleverly made a political movement, we doubt if the bill would have passed, or that Governor Hill would have thought that it did not go far enough. We shall print and discuss its provisions more at length in a later issue. Meanwhile we congratulate Mr. Wingate and the *Morning Journal* on the success that has followed their exertions in behalf of this reform.

In our issue of March 5 we criticised the majority report of the New York State Railroad Commission because its authors took the ground "that heating railway-cars from a source outside the car has not yet been demonstrated as practicable." We then stated that within a twelvemonth the signers of this report would be ashamed of the position they then took on this question. It is gratifying, therefore, to see at least one of these gentlemen admit within a month that his position was a mistaken one, and agree with Mr. O'Donnell to a supplementary report, an abstract of which we give elsewhere in this issue.

Dr. Paul Liborius, a Russian Naval Surgeon, has made some investigations as to the disinfecting powers of lime, especially on typhoid and cholera germs, from which he concludes that a watery solution of quicklime, or so-called lime-water, of from 0.0074 to 0.246 percentage of strength, will, in the course of some hours, destroy the vitality of bacilli—the lower strengths of the typhoid bacilli, the stronger ones of the cholera germs. In the course of a few hours the addition of caustic or fresh-burnt lime to cholera stools in the proportion of two per cent. will permanently and completely disinfect them.

OUR BRITISH CORRESPONDENCE.

Experiments on Filtering the Air of the House of Commons—Blasting in Fiery Mines—Electric Engines for Tramways—Sewage Disposal at Maidstone—The Sanitary Registration of Buildings Bill.

London, March 16, 1887.

In consequence of the presence of fog in the Chamber of the Houses of Parliament, experiments are being made in the direction of filtration of the air, with a view to obviating its presence.

In connection with blasting in fiery mines, it is reported from Germany that, at a meeting of colliery owners and miners' representatives in Bochum, it was decided to prohibit blasting in such mines as black powder, and also the use of naked lights and mixed systems of safety-lamps. This prohibition will be effective throughout Germany, and will bring forward mechanical apparatus for coal-getting.

Electrical engines for drawing tram-cars have for some time been on trial on a portion of the Northwestern Metropolitan Tramway Company's line at Stratford, and the result has been so far satisfactory that, as soon as the Royal assent is given to the bill, which has just passed through Parliament, the new system of traction will be adopted. The apparatus is known as Elieson's, and consists of a storage of electrical power in batteries, removable at will. The engines are geared to run about ten miles an hour, but it is said a higher rate of speed can be obtained if necessary. The stopping, starting, and rate of speed on a gradient of 1 in 30 is satisfactory. The Electrical Motive and Power Company are the manufacturers of the engines.

The Maidstone Corporation have adopted a new scheme of sewage disposal. The sewage, after treatment by milk of lime, passes into precipitating tanks, the effluent being run off into the river. The sludge is lifted to another tank for further treatment with lime. It is passed thence through a pumping-engine of special design, which extracts the remaining liquid and rejects the solid portion in the shape of cake. The effluent discharged from this engine is said to be colorless and inodorous.

The Sanitary Registration of Buildings Bill, recently introduced in Parliament, is not considered satisfactory by some of the English sanitary engineers and surveyors, who have issued a circular pointing out some of its defects, and calling attention to the efforts of individuals to modify the Public Health Acts without consulting sanitary authorities. The council of the Association of Municipal and Sanitary Engineers do not seem to have a favorable opinion of the bill.

Safety-Valve.

OUR SPECIAL ILLUSTRATION.

RESIDENCE AT NEWPORT, R. I.—GEORGE B. POST, ARCHITECT.

The subject of our special illustration is the residence of Mr. C. C. Baldwin, at Newport, R. I. It is built of brick (buff and red), terra-cotta and wood, on the front brick filling in the frame-work. Hard-wood trimmings, stairs, wainscots and floors. The architect was George B. Post, of New York.

A FARMER'S COTTAGE AT BEVERLY FARMS, MASS.—ANDREWS & JAQUES, ARCHITECTS.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

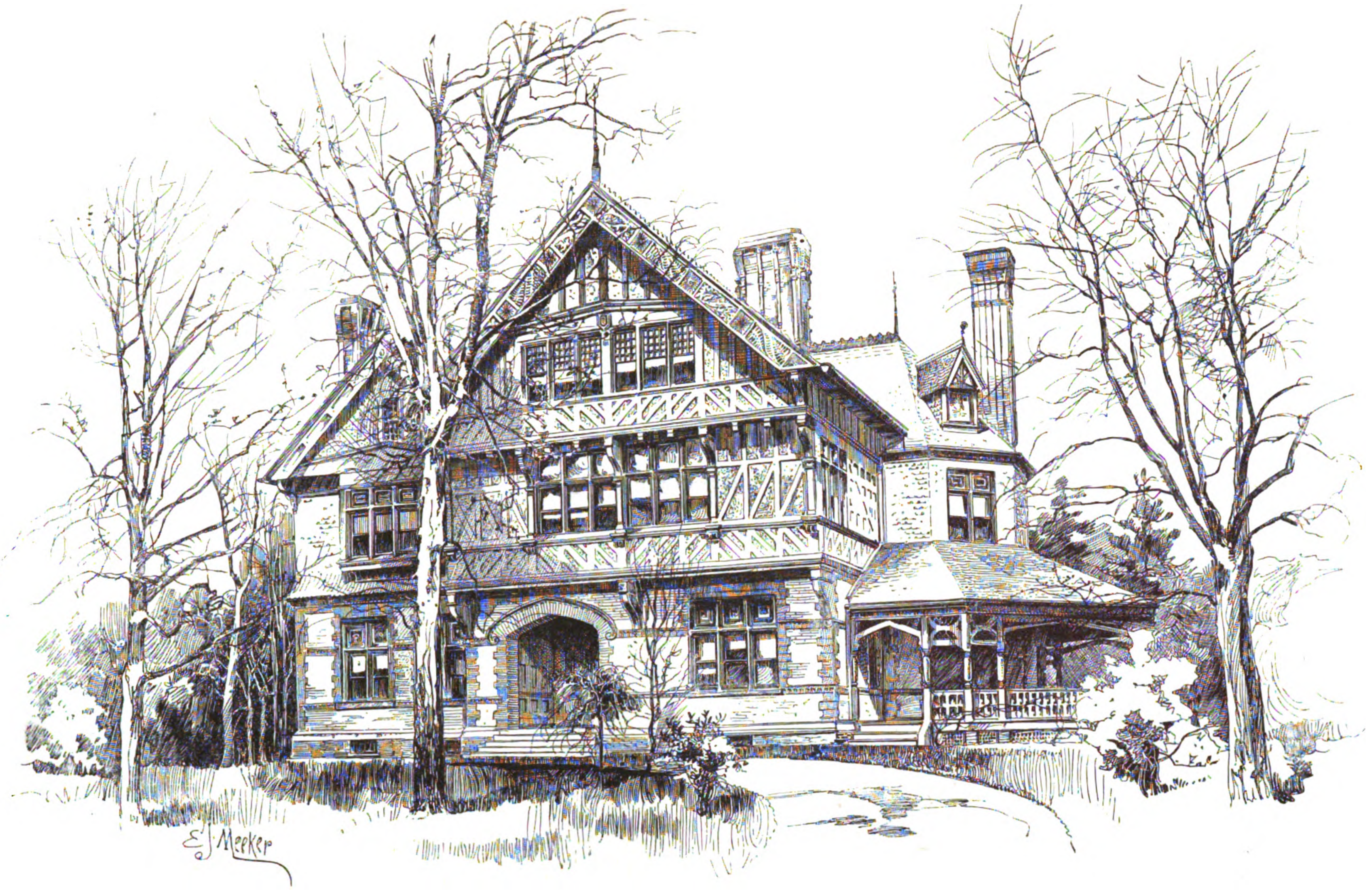
A FARMER'S COTTAGE AT BEVERLY FARMS, MASS.—ANDREWS & JAQUES, ARCHITECTS.

This little cottage, of which we give a view and plan, was built for C. H. Dalton, Esq., at Beverly Farms, Mass., at a cost of $2,200. It is of frame construction, covered with shingles, which are stained. The trimmings are painted. The architects are Messrs. Andrews & Jaques, of Boston, Mass.

OUR SHEET OF DETAILS.

Our Detail Sheet, the eighth in the series, shows some mantels in a country house. Mr. Bruce Price, of New York, was the architect.

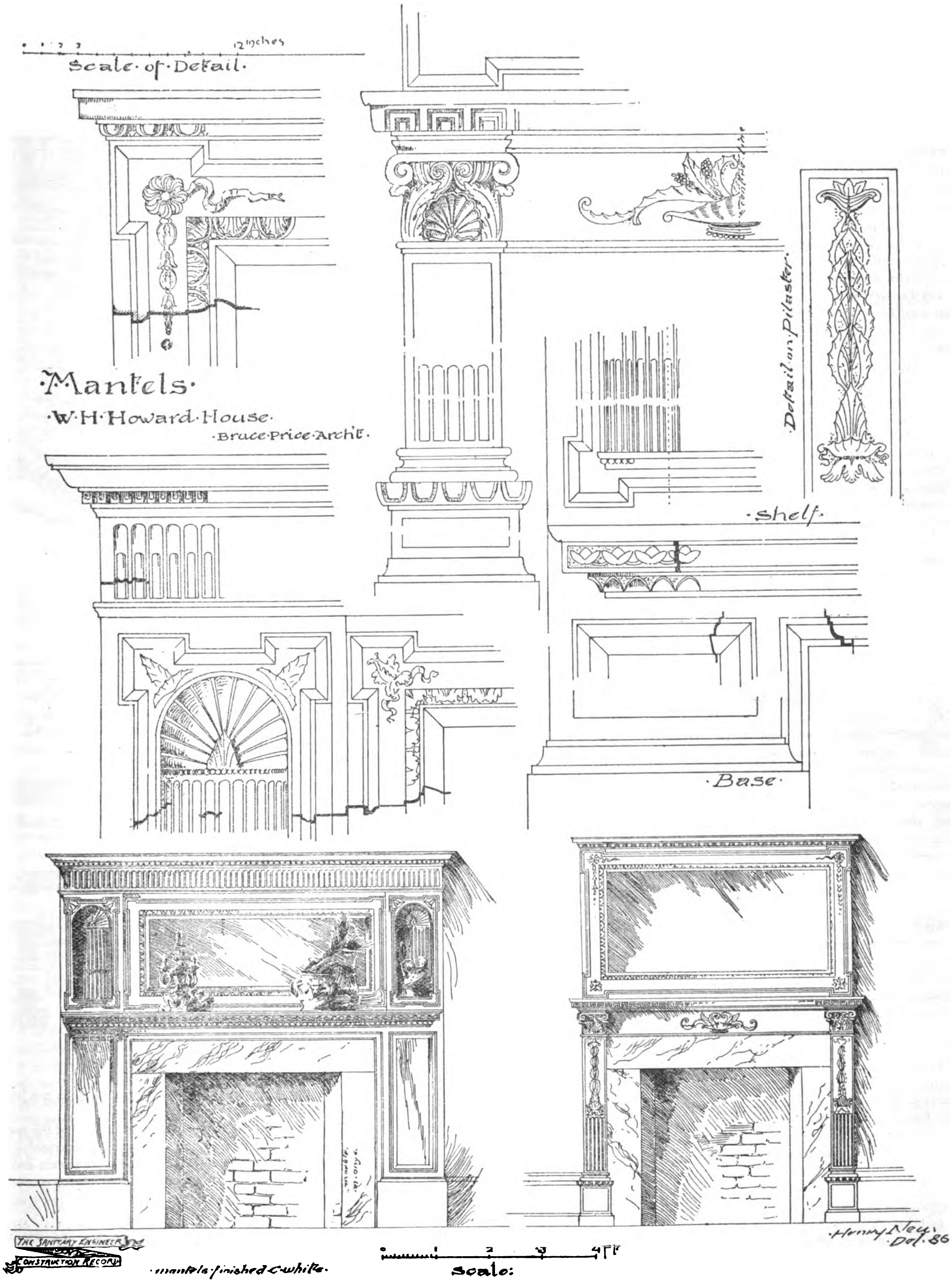
A hearing is proceeding in the Massachusetts Legislature on the establishment of a Board of Public Works in Boston, to have control of the water-works, sewers, streets, public buildings, and parks. This would unite a number of now independent departments.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCE OF C. C. BALDWIN, ESQ., NEWPORT, R. I.

GEORGE B. POST, ARCHITECT.


1 2 3 12 inches
Scale of Detail.
·Mantels·
·W·H·Howard·House·
·Bruce·Price·Arch't·
Detail on Pilaster
·Shelf·
·Base·
Henry Ney. Del. 86
The Sanitary Engineer
Construction Record
·mantels finished white·
1 2 3 4 Ft
Scale:

ENGINEERING & ARCHITECTURE

RECENT SEWER CONSTRUCTION.

No. IV.

(Continued from page 402.)

THE RECONSTRUCTION OF THE MAIN DRAINAGE SYSTEM OF THE HOUSES OF PARLIAMENT, LONDON.

THE following description of this recently executed work is abstracted from the report of the engineer, Mr. Isaac Shone, under whose supervision the work was done, our illustrations being reproduced from the same source. The plans were prepared by Mr. John Phillips, S.E., of London.

In 1839 Sir Charles Barry laid down, under the middle of the Houses of Parliament, from north to south, a large, nearly flat-bottomed brick sewer, which discharged into a similary constructed sewer in Abingdon Street, near the Victoria Tower.

This sewer, owing to its bad form, excessive size, little fall, and absence of any means for flushing it, accumulated a large amount of sewage deposit, the gaseous emanations from which continually polluted the air of the Palace.

In 1846 the smells from the Palace were so bad that Sir Charles Barry consulted Mr. John Phillips, C. E., who was then the Chief Surveyor to the Westminster Commissioners of Sewers, with a view to its improvement. Mr. Phillips, after examining the sewer, recommended that a narrow, deeply curved invert, with a reversed fall, should be substituted for the old invert, and that it should be continued northward, across the Speaker's Green, into the outlet of a sewer in Bridge Street, which latter he found to be about five feet lower than the sewer in Abingdon Street.

Sir Charles Barry not only adopted and carried out these recommendations, but the increased depth enabled him to construct two main branch drains from near the lower end of the new portion of the sewer, for draining the east and west sides of the Palace at a much lower level than they were originally.

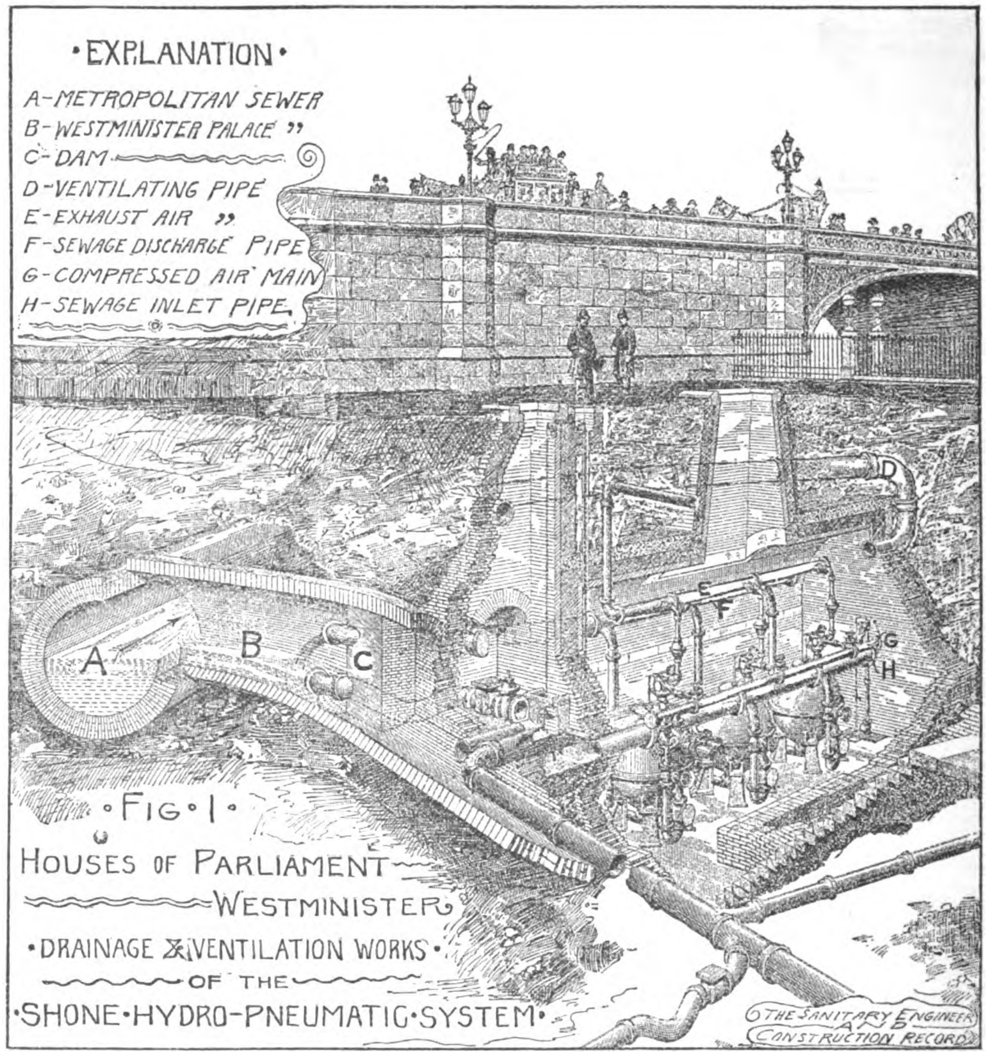
By the better gradient thus obtained, and by the narrow and deeply curved invert put in, the sewer as altered, supplemented with ample flushing power, became self-cleansing, and it continued in this improved condition for a quarter of a century, until twelve or thirteen years ago.

At that time, about 1873, the Metropolitan low-level sewer—seven feet nine inches in diameter—was put down through Westminster, and the Palace sewer was connected with it; its bottom at the junction being about twenty-one inches above the bottom of the Metropolitan low-level sewer.

Ever since this work was done there has been daily, in dry weather, from three feet six inches to four deet in depth of sewage flowing on the bottom of the Metropolitan low-level sewer, and this created a constant head of sewage against the Palace sewer outlet, converting it into a creek, for a length of about two hundred feet—containing from one foot nine inches to two feet three inches in depth of nearly stagnant sewage, which was always present upon the bottom of the Palace sewer.

But besides this, in wet weather the Metropolitan sewer was not only always filled with sewage-water, but sometimes this water has risen to ten feet above the crown of the Metropolitan sewer, or thirteen feet above ordnance datum. During wet weather, therefore, the Palace sewer, and its main branch drains, have been filled with sewage and rain-water, which could not be discharged until the flood-water contained in the Metropolitan low-level sewer had subsided, by being cleared out by the pumps at Abbey Mills, Bow, and by running it off through the sluices at Blackfriars and elsewhere into the Thames.

Hence, for twelve or thirteen years past, the Palace sewer, as well as its main branch drains, have been periodically converted into a series of sewage-reservoirs; and from these the sewage-water, as it accumulated and filled them, pressed out the foul gases contained within them, up the various contributing drains into the Palace. This discharge of sewage-gas into the Palace has been going on more particularly at night time, during the sessions of Parliament, when the gas has been burning throughout the



•FIG•I•

HOUSES OF PARLIAMENT WESTMINSTER

•DRAINAGE & VENTILATION WORKS• OF THE •SHONE•HYDRO-PNEUMATIC•SYSTEM•

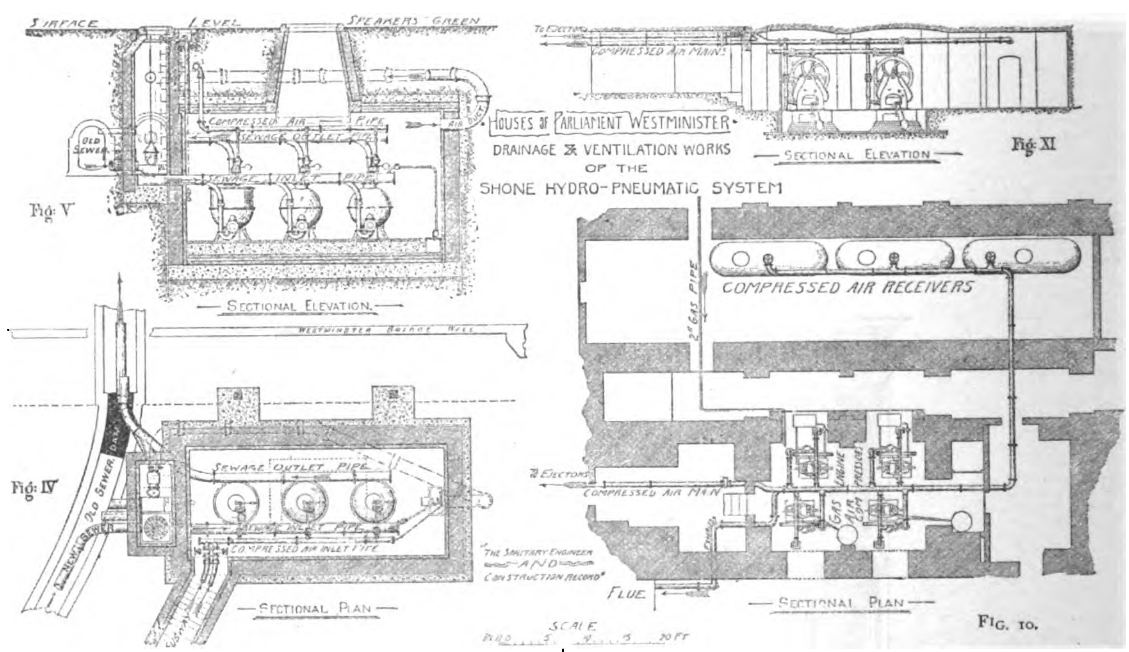


Fig. V

Fig. IV

HOUSES OF PARLIAMENT WESTMINSTER — DRAINAGE & VENTILATION WORKS OF THE SHONE HYDRO-PNEUMATIC SYSTEM

Fig. XI

FIG. 10.

Palace, and when the waste hot water and steam from the warming and ventilating appliances of the Palace were discharged into the drains and sewers, and fermented the sewage lying therein.

The unpleasant effects, caused partly by the Metropolitan low-level sewer, and partly by the sewer and drains under the Palace, as already described, became at last so intolerable that Parliament had no alternative but to reier the subject to a committee of the House of Commons.

But until the first session of Parliament in 1886 no remedy was found for the evils complained of, which then had become so pronounced as to cause the House of Commons to suspend its sitting on one occasion.

In the early part of 1886 a committee was appointed, Sir Henry E. Roscoe, F. R. S., being the Chairman.

One of the members, Mr. L. H. Isaacs, made a personal examination of the interior of the main sewer under the Palace, from the Victoria Tower to the point of discharge at the Speaker's Green; and, having regard to the then state of the main sewer (which is exemplified by Fig. 22, Plate 1), this was a disagreeable, not to say courageous, work to undertake.

He came to the conclusion that the smells so much complained of, and so frequently experienced within the Palace, were mainly due to the faulty sewers and drains under the Palace, and more especially to the connection of the main sewer with the Metropolitan low-level sewer running through Westminster.

Mr. John Phillips, sanitary engineer, also made examinations of the sewer, and of some of the branch drains, under the Palace, and endorsed the views of Mr. Isaacs in regard to the faulty character of the same. He subsequently submitted to the committee a plan for improving the main sewerage arrangements of the Palace, and rendering them perfectly independent of the Metropolitan low-level sewer as a means of discharge by gravitation.

The committee, after due consideration of the subject in all its bearings, recommended to Parliament that the plan, as proposed by Mr. Phillips, on the Shone Hydro-Pneumatic System, should be adopted; and their recommendations have been substantially carried into effect.

Figure 1 is a sectional perspective view of the pneumatic ejector station, looking from the base of the clock-tower in the direction of Westminster Bridge.

Figure 23 is a cross-section of the 1839 sewer, showing, by black color, the invert waterway necessary to pass through it the maximum quantity of sewage obtaining at the Palace when Parliament is in session. Figure 24 is a longitudinal section of the same sewer with the new sewer laid in it. Figure 20 shows the original sewer as having a gradient of 1 in 923 only, but by the alteration suggested by Mr. Phillips in 1846 it was increased in 1848 to 1 in 215. Figure 21 is a sketch plan, showing the Bridge Street sewer outlet into the Thames, as Mr. Phillips recollects it to have been 1846, and it also shows how the Palace sewer was subsequently connected with the Bridge Street sewer-outlet. Figure 22 indicates the erratic way in which the branch drains were connected with the Palace sewer in 1839 and 1848.

There were about 122 of these connections made originally, and they were formed at various levels on either side of the sewer as shown.

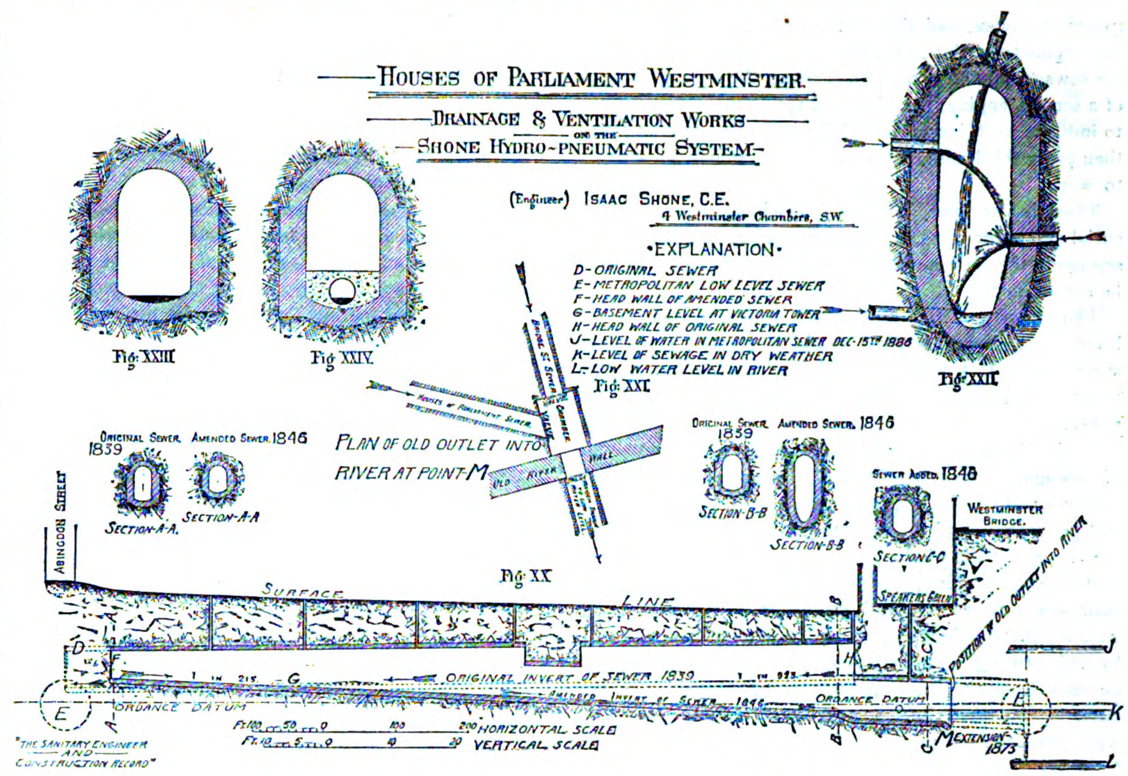
The new works consist (1) in improving the gradients of the main sewer and its principal tributaries; (2) in reducing the sizes of the sewers—the main sewer, for example, from ten feet six inches high by three feet wide, as per Fig. 22 on Plate 1—to one of twelve inches in diameter, as illustrated by Fig. 24; this latter figure also shows the waterway on the invert of the new main sewer, with its improved gradient, when that sewer is charged with the maximum quantity of sewage which obtains during the Parliamentary sessions.

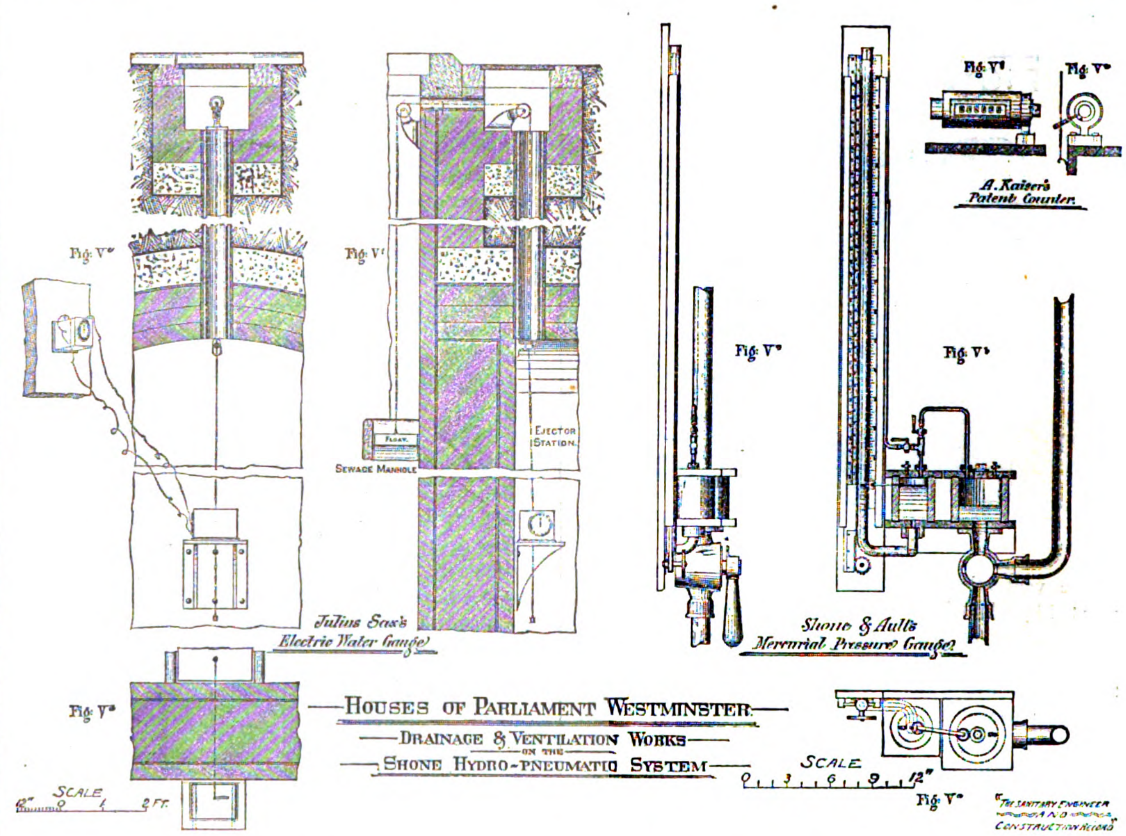
The chief tributary is reduced from twenty-four inches high by fifteen inches wide, and laid at an average gradient of 1 in 372, to a pipe-sewer of nine inches in diameter, laid at a gradient of 1 in 309; (3) in providing superior flushing appliances (Shone's automatic hydraulic flushing ejectors) for the sewers, at a considerably reduced expenditure of water; (4) in providing an improved method of ventilating the main sewers; (5) in forming proper connections between the drains and the main sewers, and giving extraordinary facilities for inspection at the junctions; (6) in severing absolutely the large tunnel-like connection between the Palace sewer and the Metropolitan low-level sewer by means of a "dam," constructed as per Fig. 4, within the former sewer; in dispensing with the big cumbrous penstock and flap-valve arrangements connected therewith, and substituting therefor a small 12-inch iron sewer with sluice and reflux-valve; (7) in providing, in case of need, improved automatic arrangements for permitting the Palace sewage and rainfall to flow into the Metropolitan low-level sewer by gravitation, on the principle heretofore adopted, independently altogether of the ejector system, but without the possibility of the foul gases from the Metropolitan low-level sewer getting into the Palace sewer; (8) in preventing the hot water and steam from the boilers, etc., from passing into the drains and sewers, and providing a separate and independent outlet for same into the Thames; (9) in providing means whereby the sewage and rainfall proceeding from the Houses of Parliament shall flow uninterruptedly therefrom both in dry and wet weather, irrespective of the height at which the Metropolitan low-level sewer is discharging sewage, or sewage and rainfall in combination.

This is effected by means of Shone's pneumatic sewage-ejectors, which are fixed in a chamber under the Speaker's Green, near the clock-tower. The ejectors are placed below the level of the Houses of Parliament main sewer, so that the sewage and rainfall flows to and into them by gravitation. There are three ejectors, one of 500 and two of 350 gallons capacity. They can be worked separately or unitedly, just as the flow of sewage or rainfall is small or large.

They do not, as is the case with pumps, permit sewage-sludge or road detritus to accumulate in the pit, sump, or well pumped from; for they themselves become, as it were, the equivalent of so many pits, sumps, or wells, into which the sewage and rainfall flow by gravitation. All foreign matter heavier than water settles on the bottom. The longest time, however, during which this temporary settlement of heavy matter takes place does not exceed fifteen minutes at most, and this only happens when the minimum flow obtains—viz., at the time when Parliament is not in session.

Owing to the wash-out shape of the delivery-pipe proceeding from the bottom of the ejector, the action of ejection results in the heavier matter being expelled first out of the ejectors, which are thus rendered self-cleansing.





The ejectors are always receiving fresh compressed atmospheric air when the sewage is being expelled out of them, and the surplus of this air—*i. e.*, the volume of air which exerts a pressure superior to that of the atmos here—and which is innocuous—after each charge of sewage has been ejected, escapes through the exhaust-ports of the automatic gear into a pipe which conveys it to the ventilating-shaft in the clock-tower, whence it escapes into the atmosphere.

The ejectors are self-acting, and work only when they have work to do. They are emptied in about half a minute; but they take in dry weather, when Parliament is not in session, from ten to fifteen minutes to fill.

The compressed air required to expel the sewage and rainfall is supplied by air-compressors, driven by Atkinson's patent differental gas-engines. There are four of these (of four horse-power each) situated in the basement of the Palace, about 650 feet from the ejector-station, illustrated in Fig. 2.

Figures 4 and 5 are a plan and section of the pneumatic ejector station, and Figs. 10 and 11 a plan and section of the air-compressing station.

The minimum lift for the Palace ejectors is twelve feet, and the maximum lift will probably never exceed twenty feet.

By the aid of Kaiser's Counters, attached to the ejectors, they become sewage-meters, giving accurately the quantity of sewage in dry weather, and of sewage and rainfall combined during periods of wet weather.

From observations already made since the ejectors have been at work, it is clear that one gas-engine air-compressor and one ejector will deal with more than the whole of the largest quantity of sewage flowing from the Houses of Parliament at any one minute of time, even though that sewage should be supplemented by an amount of water equal to one inch and more of rain falling upon the entire area of the Palace and grounds in twenty-four hours.

When these are insufficient, during periods of extraordinarily excessive rainfall, there is a float within the sewage manhole, adjacent to the ejector-chamber, which will rise and fall with the sewage and rainfall, and will actuate one of Mr. Julius Sax's automatic electrical tidal-water gauges.

This is fixed within the ejector-chamber, and a duplicate of it also fixed in the gas-engine room, both being operated simultaneously by the float.

These instruments indicate the exact level, in inches, of the water in the sewage manhole from which the ejectors are supplied.

The moment one engine is overcome the electrical apparatus rings a bell within the ejector-chamber, and in the

gas-engine room, and then the attendant will set a second gas-engine to work; but if the sewage continues to rise in the sewage manhole, notwithstanding the setting to work of a second engine, the electrical apparatus will continue to indicate such increased height, and the attendant will then put a third, and, if necessary, the fourth gas-engine to work.

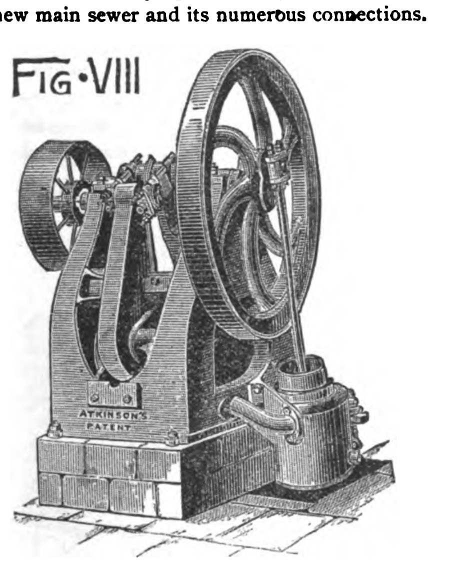
There is also fixed, in the ejector-chamber, a semi-mercurial and water-pressure gauge, by which the height of the sewage in the Metropolitan low-level sewer can at all times be determined.

The velocity of the flow of the sewage shown on the invert of the sewer of 1839, would be about 1.11 feet per second, and this volume of sewage would only occupy about the $\frac{1}{16}$ part of the entire sectional area of the sewer.

By the alteration made, the velocity of the same volume of sewage, carried in the new 12-inch iron pipe, laid on the invert of the improved 1848 sewer, would be 2.8 feet per second, and the waterway area would be equal to the $\frac{1}{14}$ part of the whole.

Besides improving, hydraulically, the capacity of the main sewer to receive and discharge the minimum as well as the maximum quantity of sewage and rainfall, by substituting a 12-inch sewer for the old one, it will be seen from the drawings that the upper portion of the latter is converted into a convenient subway—which is well ventilated—along which workmen can pass to and fro in comfort, for the purpose of inspecting the condition of the new main sewer and its numerous connections.

FIG·VIII



The ventilation of the new 12-inch main sewer is effected by admitting fresh air into the subway which puts the basement of the Houses of Parliament into direct communication with the ejector-chamber, and allowing it to proceed, firstly, along that subway into the ejector-chamber; secondly, through the ejector-chamber into an air-duct at the top of the eastern end thereof; and, thirdly, along this air-duct into the sewage manhole.

The air is made to pass out of the sewage manhole partly into the main 12-inch sewer and partly through the rectangular air-opening, which communicates with the subway above the main sewer.

That portion of the air which passes into the 12-inch sewer proceeds direct to the furnace at the base of the Victoria Tower; but, before diverging from the line of the main sewer, it is joined by the air-current which travels from the head of the sewer. Both currents therefore go together—from the point of divergence in the new 12-inch main sewer—into and out of the Victoria Tower, along with the volumes of vitiated atmosphere proceeding from the Palace.

That portion of the air which passes through the rectangular opening in the sewage manhole into the old sewer subway travels along that subway for a short distance only, when it makes a detour to the right, along with the air that is admitted at the head of the old sewer subway (to ventilate it), and proceeds along an air-duct direct to the furnace at the base of the clock-tower.

The air that ventilates the smaller 9-inch sewer is drawn from the upper end of that sewer to the clock-tower furnace.

The consumption of cannel-coal gas, when one engine is running and compressing air to about 10 pounds per square inch continuously for twenty-four hours, is about 2,000 cubic feet, which costs—reckoning gas at the price paid for it—viz., 3*s.* 9*d.* per thousand—7*s.* 6*d.* ($1.80) per day; which is just 3¾*d.* per hour for the four-horse-power engine, or less than 1*d.* per horse-power per hour.

Engines require no other attention than that needed for lubricating, and occasionally to clean them; and the ejectors —one of these has already been left to itself for a whole week, working night and day without anybody either lubricating or attending to it in any way.

One of the gas-engine air-compressors and one of the ejectors of the Palace, working continuously for twenty-four hours day and night, could deal with the sewage of more than 20,000 people, reckoning the sewage discharges at twenty gallons per head per day—the lift to be twenty feet; and the total gas consumption would be no more than it is at the Houses of Parliament.

The works were divided into three contracts, the general contract (No. 1) being let to Messrs. John Mowlem & Co., of Westminster; and the special contracts (No. 2)—embracing the supplying and fixing of the pneumatic and hydraulic ejectors, to Messrs. Hughes & Lancaster, Chester; and (No. 3) for the supply and erection of the gas-engine air-compressors, to the British Gas-Engine and Engineering Company, Queen Victoria Street, London.

BAY CITY, MICH., WATER-WORKS.

THE fifteenth annual report of the Bay City, Mich., Water-Works shows an increase of thirty-eight taps during the year and a diminution in the consumption of 154,000 gallons daily. How much of this apparent reduction is due to the stoppage of thirty leaks in the 24¾ miles of pipes, and how much to the fact that a new Gaskill engine was put in service during the last three months, relieving the old Holly piston and rotary pumps, which probably registered more water than they really pump, does not appear. The saving in fuel (pine slabs) from the greater efficiency of the new engine was very marked, being 150 cords during November and December.

The amount of water consumed is altogether too great for the number of consumers, being 1,675 gallons daily per tap. There are 1,276 service-taps, with 174 meters, 104 of which are on domestic services, of which the average daily consumption is 816 gallons. This appears very large, but there are a number of hotels, stables, and "blocks" on the list, and as the unmetered taps consume each 1,730 gallons daily, it demonstrates the advantage of metering services. A reduction of even half the difference between metered and unmetered taps would save the pumping of nearly 200 million gallons a year, which is equivalent to a saving of $850 a year for fuel.

Five-sixths of the pipes in Bay City are the Wyckoff wooden pipe, and they have stood well. A length of 332 feet of six-inch pipe, which had been in use since 1874, was taken up last year and found to be in such good condition that new thimbles were put on it and it was relaid in another locality.

There were in this city of 32,000 inhabitants, 113 alarms of fire during the year 1886, necessitating the operation of the pumping-engines for 73 hours at high speed, and a pressure on the pumps of 84 pounds per square inch. For fire purposes there were pumped altogether 11,200,412 gallons, being about 1½ per cent. of all the water consumed.

The maintenance of the water-works cost $14,528.61, and the revenue from consumers was $19,386.97.

Extensions and betterments of the works cost $36,-736.21.

In his very clear and full report, Mr. E. L. Dunbar, the Secretary and Superintendent, estimates that the department is entitled to a credit from the city for $11,750 for hydrant service and public water.

During the fifteen years of their existence the water-works have cost the city $573,348.16, and the revenue has amounted to $183,292.75. The outstanding bonded indebtedness is $377,000.

The superintendent has shown good judgment in appending to the report a summary of statistics in the form recommended by the New England Water-Works Association.

SURVEY OF THE MOUTH OF THE BAYOU PLAQUEMINE.

THE letter of Major W. H. Heuer, of the U. S. Engineers, to the Chief of Engineers, transmits a report on the project to connect the Bayou Plaquemine with the Mississippi River by locks, made by Lieutenant Oscar T. Crosby, and endorses the same.

The discussion is chiefly on the comparative merits of spur-dikes and revetment-work for preventing caving of the banks of the river at the entrance. The former is chosen on account of less cost and probable greater durability.

There is also a discussion of the question of the omission of side walls to the locks, and of the improvement of the channel through the Bayou.

PROPOSED BREAKWATER AT THE HARBOR OF SAN LUIS OBISPO, CAL.

THE report of Major W. W. H. Benyuard, U. S. Engineers, and the Supervising Engineer, Colonel G. H. Mendell, recommends a limited expenditure to give sufficient present protection to vessels in the harbor, and await the developments and future ends of commerce. The low line proposed, reaching to low water only, will be 2,300 feet long, and cost $285,000. The width on top to be 25 feet, outer slopes 1 to 3, and inner slopes 1 to 1.

SYRACUSE WATER-SUPPLY.

THE New York State Board of Health was asked by the Mayor and Common Council of Syracuse, N. Y., to advise them as to the relative sanitary merits of several practicable water-supplies for the city, and Professor James T. Gardiner has made an elaborate report in which the topography of the water-sheds and the character of the waters are fully described and discussed. His conclusions are that the East branch of Salmon River, with a water-shed of eighty square miles, will furnish sufficient water, and that if put into a reservoir "the conditions and environment of the water would be such as not to favor the development of micro-organisms." Of the water of Oneida Lake, he says that "the natural conditions of the lake are such as to favor the development and possible reproduction of microbes in the lake and some of its tributaries," and that a supply from this source must be considered of a doubtful sanitary character. Of a supply which can be obtained by building a dam 200 feet long and 90 feet high across Onondaga Creek, and flooding the Cardiff Valley, he states that "the reservoir and its tributaries would be exposed to but few sources of contamination from disease-producing microbes," and that the water would not present conditions favorable to the development of micro-organisms.

Cazenovia Lake is declared to be too small, and Skaneateles Lake water is "increasingly liable to specific contamination from summer residences."

SUGAR IN CEMENT.

THE tenor of all the accounts thus far given of the use of sugar has been that a remarkable increase of strength ensued. The *Engineer* of February 11 gives results of some tests which seem to have been carefully made, and which prove quite the contrary to be the case, as follows: Mr. A. N. Barnes, in his communication, says:

"The cement and sugar were kept in tightly-closed vessels in the interval of twenty days between the gauging of the two lots of twenty-four briquettes each. The first twenty-four were treated in the usual manner; they were immersed twenty-four hours after removal from molds. The second twenty-four were never immersed, but kept in air until tested. Sugar appears injurious to cement under both conditions, but less in the latter than in the former case. The weight of the material was the same in both lots of briquettes.

Results given by Briquettes of Neat Cement, Gauged with Water, and with Sugar and Water.

Setting time of pats of each gauging of immersed briquettes.	Sugar.	Age of briquettes before testing, and resistance to tensile stress in lbs. Immersed. 7 days.	Immersed. 14 days.	Immersed. 21 days.	Kept in air. 7 days.	Kept in air. 14 days.	Kept in air. 21 days.	Setting time of pats of each gauging of briquettes kept in air.
	oz.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
3 hours.	0	620	800	700	632	600	750	90 min.
8 min.	½	200	120	Failure.	200	270	342	36 min.
31 min.	1	70	66	45	272	310	320	3 hours.
2½ hours	1½	113	215	148	196	186	380	50 min.
40 min.	2	158	100	135	118	108	155	45 min.
50 min.	2½	122	222	112	150	230	141	30 min.
30 min.	3	125	245	136	178	300	323	47 min.
80 min.	3½	Failure.	22	Failure.	180	300	312	2 hours.

THE Master Builders of Hartford, Conn., have formed an association to regulate the hours of labor, arbitrate in strikes, and adjust the relations of employers to employees. The officers are: President, Watson H. Bliss; Secretary, John C. Mead; Treasurer, James T. Porter; Trustees, Erastus Phelps, John B. Garvie, L. J. Young.

DOMESTIC PLUMBING HEATING LIGHTING VENTILATION ENGINEERING

HOT-WATER HEATING AND FITTING.*

BY "THERMUS."

No. I.

THE growing demand for a better general knowledge of hot-water heating for buildings by the pipe-fitting trades in the United States induces me to give a description of American practice in hot-water heating, as I find it, both in this country and in Canada.

In the United States most of the Federal buildings are warmed by hot water, and a considerable number of private dwellings throughout the country have been warmed successfully by different special hot-water systems, but, as compared with the amount of steam-heating done, it is comparatively small, and the knowledge on the subject is limited or confined to a very few who have made a specialty of it in connection with green-house warming. In Canada the hot-water apparatus appears to stand in the highest favor for house-warming, although the use of steam apparatus is not rare by any means. At the present time, however, the people of Canada seem to be considering the question of steam plant more than formerly, and many new buildings are being warmed by steam, while the people of the Northern, Middle, and Eastern States of the Union are studying the problem of warming by hot water and adopting it, though slowly and cautiously, in more cases than heretofore.

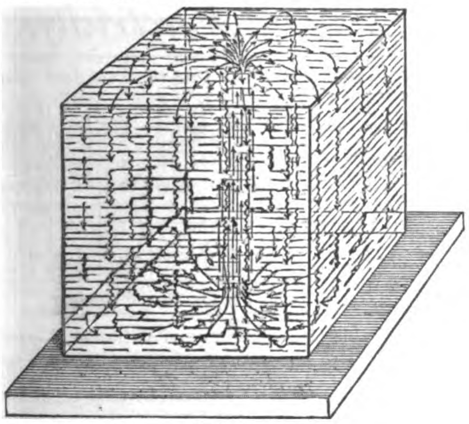


FIG. 1.

Before going into the question of methods employed for the different class of buildings and their details, it is well, perhaps, to say a few words on the laws of hot-water circulation, that the reader may understand terms and technical applications as they appear and the more readily comprehend and reason by analogy when considering different classes of work, which, however much they differ in appearance, are all controlled by a few common laws that must never be lost sight of in constructing a hot-water circulating apparatus; the chief one of which is that as each particle of water loses its heat by giving it off to the air, etc, through the walls of the pipes and heaters, that it becomes heavier than the particles of water surrounding it and falls by the law of gravitation, displacing warmer particles than itself, which by the interchange of position rise above it, producing what is called circulation.

This takes place in all waters and in all liquids without regard to mass or shape. If we have a glass or iron cube filled with warm water, say one foot square, or any convenient size, as shown in Fig. 1, with all sides but the lower one presented to the cooling action of the surrounding air, and radiating heat as well, which latter it will independently of the air, we find we will have currents in a downward direction on the four outer sides close to the glass, as shown by the waved arrows, while at the same time there will be noticed a current ascending at the centre, as shown by the darts. This circulation will be noticed to go on in any vessel of water that is removed from its source of supply of heat.

If, however, instead of standing on the table cooling, this cube were placed over a fire, as on a stove, so as to receive heat through its bottom, it would be found that the circulation or movement of the water would be in just the same direction as before, though possibly much stronger and faster; the only difference being in the *cause* that produces the circulation.

In the first case, the particles cooled by contact with the sides of the cube, through which their heat was conducted away from the mass to warm the air on the outside, and in consequence of which they became smaller and more dense than their neighbors immediately behind and about them which had not as yet come in contact with the outsides of the cube, and they sink, forcing an equal number of particles out of their way, and as the latter cannot escape from the cube, they are forced to rise elsewhere within it, which, in the case of a cube exposed on four sides, must be near or at the centre.

In the second case, although the circulation is identical so far as appearances go, we cannot consider that the outer particles are forcing their way down, as in all probability they will be receiving heat from the stove, and would, under such conditions, relatively have a tendency to go up instead of down, and hence we are forced to the conclusion that it is the light particles in the centre that are forcing their way up, and that the ones at the sides are simply forced down by the greater upward pressure at the centre.

In the one case, then, the force of gravity is bringing down the particles as they cool, and in the other the force must be that of heat, or its mechanical equivalent, which overcomes gravity.

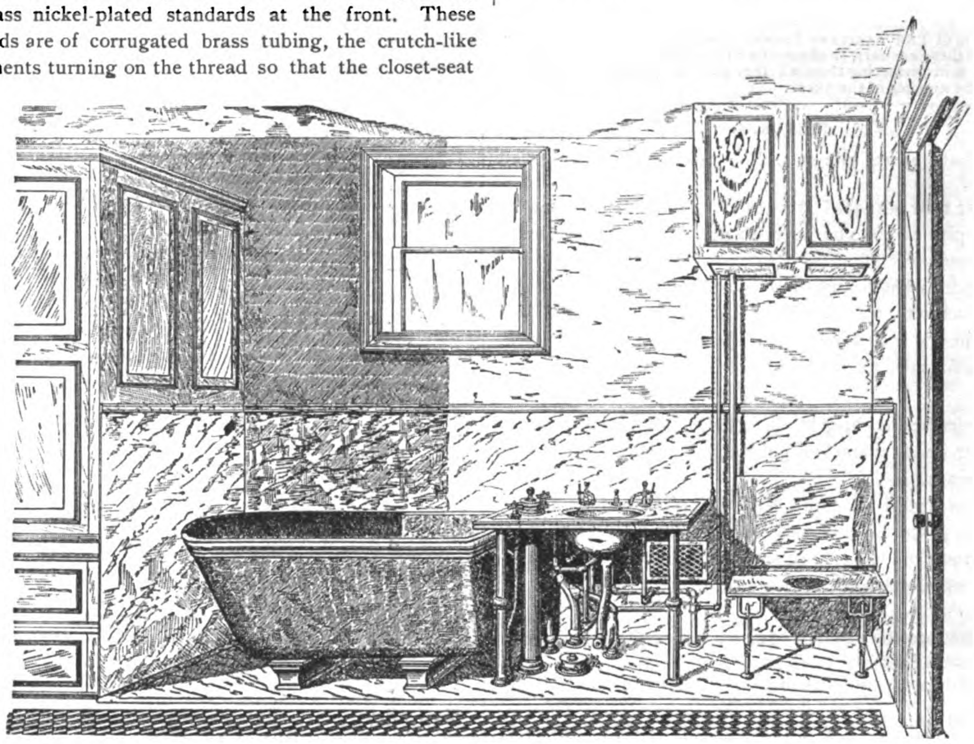
(TO BE CONTINUED.)

* NOTE.—These articles will be a continuation of the series on "Steam-Fitting and Steam-Heating" by the same author.

BATH-ROOM IN MR. GEORGE VANDERBILT'S RESIDENCE.

WE illustrate this week the bath-room in the residence of Mr. Vanderbilt, No. 9 West Fifty-third Street, New York.

It will be seen that the method of exposed work has been carried to its extreme limit, the only wood-work being the closet-seats. The fixtures (a wash-basin, water-closet, and porcelain bath, with finished rim) are set on a white marble safe, extending some six inches beyond the bath and made in two pieces. The closet-seat is supported by screws to the wainscot (which is also of marble) and by two brass nickel-plated standards at the front. These standards are of corrugated brass tubing, the crutch-like attachments turning on the thread so that the closet-seat may be raised or lowered at will and set at any desired height. The basin is supported on two ornamental brass legs, nickel plated, and the bath on two molded blocks of marble. The water-pipes are all of brass, nickel-plated, as are also the fittings of the fixtures, while the lead pipes are covered with a silver bronze, making the various parts of the work harmonize with a most pleasing effect. Most of the brass-work, including the faucets, were made from special designs.



The handles for the bath, water and waste valves are brought up through the basin-slab with neat flanges, so that both fixtures are controlled at the basin.

The master-plumber was Mr. Alexander Orr, of New York.

A LECTURE ON PLUMBING TO PHILADELPHIA ARCHITECTS.

THE first of a series of lectures on the subject of plumbing was delivered on Tuesday evening, March 22, before the Philadelphia Chapter of Junior Architects of this city, by Mr. George F. Brown.

Mr. Brown stated the general principles that should govern the drainage-system of a house, enumerating among others the following details. Referring to house-drains he said:

The iron soil-pipes should not be made too light, as they do not possess the required strength. When cast too thin they are as hard as chilled iron, and about as brittle and difficult to cut as glass, a slight blow cracking or splintering them to atoms. They are more liable to sand holes, and therefore untrustworthy, while the cost for the extra heavy is but little more.

The trap should be located just inside the cellar-wall or outside the house in a manhole, with a 4-inch fresh-air inlet branching from it as close to the trap as possible, to secure a free circulation of air throughout its entire length, and carried two feet above the surface of ground away from windows. The use of covered perforated inlets at the curb he deprecated because of their liability to clogging by dirt, snow, and ice, and said the proper place for them is above the surface of the ground not too near windows or doors. All branches entering this drain should be of the Y, and not T, pattern.

Vertical lines of soil and waste pipes should be turned at their base to a horizontal position with long one-quarter or one-sixth bends, and running in the most direct and straight lines to and through the roof full size above the highest point, remote from windows, ventilators, and chimneys. If alongside the latter, keep well below the top to avoid down draughts. The tops of these pipes should be left perfectly free and open, without cowl or ventilator, which not only aggravates the circulation of air, but offers a good place for the accumulation of hoar-frost, by the warm air from the drain in severe cold weather and, he advised the increasing of the size of pipe at the upper end.

The fact that deviation from straight lines increases the friction proves that the cap or bend or cowl, one or another of which is almost always used, is of no real utility in a light wind, but is an absolute obstructor during the light winds or calms. The best results will always be obtained by running the soil-pipe straight up to a certain elevation above the roof, more or less, according to the exposure, and leaving it entirely open at the top, or, to prevent accidental obstruction, the ordinary wire basket could be inserted into the mouth of the pipe and securely fastened.

The horizontal drain in the cellar should be suspended from the ceiling by strong wrought-iron double hangers fixed to the timbers of it along foundation-wall, supported by brick piers or strong wrought-iron rests driven well into the wall between the joints.

The vertical line of soil and waste pipes should be supported at their base by brick piers or stone posts to sup-

port its weight, and not depend on the clamps used to hold it in position.

In jointing cast-iron pipe the spigot-end of one pipe must enter as straight as possible to the hub-end of the next to secure a perfect joint, and changes of direction should be made by means of bends at all times when at all possible. These joints should first be rammed with oakum or hemp to about one-third its depth to prevent the molten lead running inside the pipe, and the rest filled with soft pure lead and thoroughly calked, or about one pound of lead to every inch diameter of pipe. The joints can and should be made light without the use of putty or paint, and it is suggested never to allow them to be treated with cements of any kind, but left exposed, showing the marks of the calking tool in the lead, after the lead wastes are calked into their respective branches.

Care should be taken to have a sufficient fall in waste-pipes to insure all water running off, letting them stand empty. All lengthy horizontal runs are to be avoided by placing fixtures near as possible to the vertical lines. No pipe should be placed behind anything but a hinged casing, or if under the floor, provided with a continuous support on boards with proper grade.

There are fixtures and waste-pipes that should not be connected with the drain. Refrigerators should not do so, but run into an open pail, or into the sink, or in cases of very large ones, a stop-cock can be attached so as to cut off connection with the drain when not in use; and overflows from tanks, drip-pipes from safes and floor linings, sediment or waste pipes from boilers, should not be connected with the drain under any circumstances, but should be discharged into the gutter of roof, an open sink, or the open-air drip-pipes should terminate just below the ceiling of basement or cellar, either with end left open, or perhaps a better way is to turn the end up, forming a prop, and then caging a rubber ball on top.

The address and discussion consumed nearly three hours' time.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. XI.

(Continued from page 432.)

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

FIXTURES.

1. What general rule should be observed in regard to all fixtures?

To use only standard articles of good quality, and to arrange pipe so as to be accessible and in as simple a manner as possible.

2. Under what fixtures are safe linings usually placed?

Water-closets, wash-basins, baths, sinks, wash-tubs, etc.

3. When is it customary to dispense with them?

When fixtures are on basement floor or cellar.

BATHS.

4. Describe the three kinds of baths in general use?

Copper-lined, enameled, galvanized, or painted iron and earthenware.

5. How would you line a bath with planished copper?

This is properly done only by coppersmiths. Plumbers are not required to perform such work.

6. Does porcelain enamel peel off?

Yes.

7. What are the usual modes of supplying a bath with hot and cold water?

Through separate cocks or by the double or combination bath-cock.

8 What is the usual size of hot, cold, and waste pipes?

⅝-inch for supply, and 1¼ or 1½ inch for wastes.

9. Is there any objection to having hot and cold water brought through the same pipe?

No; if properly arranged it is not objectionable.

10. Describe the three kinds of wastes in use?

The plug and chain, the valve, and the standing overflow.

11. What is a standing overflow?

A tube having a hollow ground plug to fit outlet of fixture, and of such height as to let off surplus water.

12. When a bath is near a water-closet where is the waste-pipe usually led?

To a point below or beyond the traps of water-closet.

13. Is there any advantage in having the waste-pipe large?

Yes. It empties tub quicker and causes a better flushing of soil-pipe.

14. Is there any objection in supplying the hot and cold water through the waste-pipe?

Yes; as the filth of waste-pipe is washed back into tub. Not usually done.

15. Is the shower usually supplied with hot and cold water through one pipe?

Yes; necessarily so, to prevent danger of scalding.

16. How large should this pipe be?

Five-eighths of an inch.

17. If the bath is supplied with two ½-inch pipes, how large should the overflow be?

One and a half inch.

18. What occasions the suction of air through the water of a bath when nearly empty?

The effort of air to get through water to fill vacuum.

(TO BE CONTINUED.)

THE NEW YORK TRADE SCHOOLS.

FOR the first time in the history of the schools, the New York Master Plumbers' Association has this winter appointed a committee to examine the boys in the plumbing course. This committee (Messrs. Macdonald, Muir, Mead, Scott, and Edward Murphy, Instructor in Plumbing) have been conducting the examination for several evenings, and concluded it this week. About fifteen of the boys were examined each evening, first on specimens of their handiwork, second on the questions of the plumbing course, and finally on questions prepared by Colonel Richard Auchmuty, with drawings, showing blunders, and asking the boys for the remedies. The attendance was also taken into consideration. As this is the first time the boys have been subjected to this test and as they did not know they were to be examined, Colonel Auchmuty feels very much gratified at the proficiency shown. The association will present to the boys certificates that they have passed a satisfactory examination on the theory and practice of plumbing, and in consideration thereof will receive a deduction of one year from their apprenticeship from the members of the New York Master Plumbers' Association.

Certificates hereafter may be graded to show comparative excellence, but as the boys did not prepare for this examination, they will not be graded this first time.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

FLUSH-TANK.

THE illustration herewith represents a combined self-acting and operable flush-tank, designed by the firm of Geneste, Herscher & Co., and published in the *Nouvelles Annales de Construction*. The bell over the outlet rests upon a water-tight seat at the bottom, and is attached at the top to the stem of a ball-cock, and also to the end of a lever to be operated by hand. Hence, whenever the ball-cock rises under the action of the inflowing water to a certain height, the valve at the bottom of the bell opens and lets water escape. This water draws the air out of the

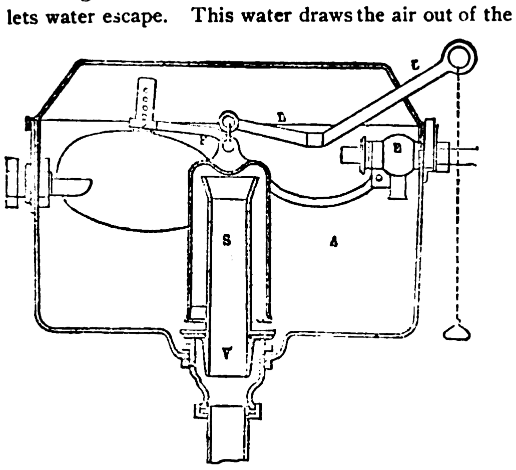


Fig 1.

bell as in the ordinary Field flush-tank, and when the water ceases to escape through the valve, the balance of the tank is emptied by syphon action. The hand-lever enables the same operation to be effected at any height of water in the tank.

Another ingenious arrangement for the same purpose is that of MM. Rozier and Mothes, Fig. 2, in which the same action (it is not as shown in the figure automatic) is effected by raising the bell *d* by means of the chain V and the rubber valve B. This causes a partial vacuum under the bell,

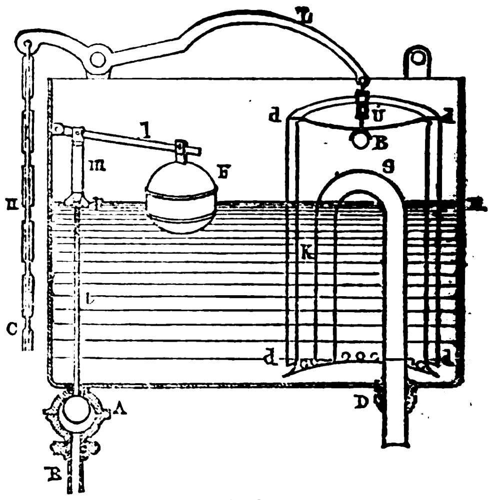


Fig. 2.

and the water rises up and starts the syphon action, which continues until the tank is emptied. When the bell is dropped the valve B opens and restores the air equilibrium. The valve at A is also a rubber ball. The inner reversed bell shown in the cut which is pierced with holes around the bottom for the admission of the water does not appear strictly necessary to the operation of the apparatus, but is apparently inserted as a guide for the movable bell.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
March 26........ .. .	25.65	20 40	20.98	29.02	28.17	24.89	31.80

E. G. LOVE, Ph.D., *Gas Examiner.*

THE Equitable Gas Company, of Baltimore, has reduced the price of gas to thirty-five cents per 1,000 cubic feet.

AT the meeting of the National Electric-Light Association of the United States, Mr. E. J. Houston expressed the opinion that "of all the bright future which seems to be in store for us, as those interested in electrical matters, that in the direction of electric-motors the sky appears to be the brightest."

A FEW arc-lamps which were recently introduced for street-lighting in Berlin are to cost the municipality six cents per hour each.

THE ELECTRIC-LIGHT IN THE PARIS THEATRES.

THE Prefect of Police at Paris has issued some regulations with regard to electric-lighting in theatres. The employment of bare arc-lights is very properly prohibited. A tray is to be placed below the globe in order to catch any loose pieces of carbon, and the globe itself is to be surrounded with a metallic network. This also is perfectly reasonable, but when a similar regulation is applied to incandescent lamps it strikes us as being unnecessarily stringent. The rules require that all incandescent lamps are to be provided with a metallic network surrounding the globe in order to prevent fragments of glass from falling upon any one underneath. If such a rule is required at all it should certainly be applied equally to globes surrounding gas-flames, which are far more liable to fracture than are incandescent lamps.—*Electrician.*

"I had typhoid fever at the age of eighteen, when I first came to Paris. The owner of the house in which we lived said to my mother: 'It is very unfortunate to die at eighteen; one has then cost much and repaid nothing.' I was angry at this speech; yet it is quite true, at the age of eighteen or twenty, the typhoid fever age, the youth has cost his parents and his country much, and has as yet produced nothing. By lessening the number of deaths from typhoid we shall do much for France."—P. BROUARDEL, *in Revue Scientifique.*

THE CHILDREN OF THE CITY; WHAT CAN WE DO FOR THEM?

BY JAMES B. RUSSELL, M. D., LL.D.

[Medical Officer of Health of Glasgow.]

DR. JAMES B. RUSSELL, Health Officer of Glasgow, who has always taken a great deal of interest in the welfare of the tenement-house population, and has done a great deal for this class in Glasgow, visited this country last fall. After his return he delivered an address under the above title, from which we give the following abstract, as it touches one of the great problems of the times:

Dr. Russell said that despots had always regarded the growth of cities with jealousy. Cities had in all ages been the birthplaces of movements in favor of popular rights. Still, the physical necessities begotten by the aggregation of men had always formed the chief element in the difficulties of their government. In the cases of Paris and London attempts were made, at a very early date, by the sovereigns of France and England, to check their growth by direct prohibition. The most important of the features of city life which troubled the minds of kings still existed. It rested now with the sovereign people to attempt with more success to solve the problem, and it was his object to help the accomplishment of that object. Louis XIV. of France and Elizabeth of England had, in their respective edicts, stated reasons why their capitals should not increase in size, those which still remained of vital importance being "that the country would be depopulated," and that the people would be "heaped up together, and in a sort smothered with many children" in small houses, and that towns were unwholesome as compared with the rural districts. He proceeded to show the growth, manner of growth, and the characteristics of a town compared with a country population. In 1861 it was found that 63 per cent. of the entire population of England lived under urban conditions: in 1871, 66 per cent.; and in 1881, 68 per cent. The extraordinary and portentous growth of London deserved special notice. In 1801 out of every 100 of the entire population of England 11 were inhabitants of London, and this proportion had advanced till in 1881 it had reached 15. In Scotland, in 1861, 61 per cent. of the entire population lived in towns; in 1871, 65 per cent.; and in 1881, 69 per cent. The absorption of the rural population was advancing more rapidly in Scotland than in England, and the fact assumed more importance when it was noticed that it was into the eight principal towns that the population was flowing. While the proportion in the smaller towns and villages was falling off, the proportion in the chief towns was rising from 29 per cent. in 1861 to 32 per cent. in 1871, and 38 per cent. in 1881. Glasgow was absorbing the population of Scotland even more rapidly than London that of England. In 1871 Glasgow and its suburbs contained no less than 17 per cent. of the inhabitants of all Scotland, and in 1881 this proportion had risen to 18 per cent. In towns there was always a much greater proportion of adults of both sexes. The marriageable females were greatly in excess of the males of the same age. Early marriages were much more frequent and the birth-rate was higher. But though the town population was more productive, it was less conservative of child life than the rural population. Another sinister characteristic of a town population was that, while above 45 in country districts the proportion of persons still living in the married state was maintained, in towns it fell off in comparison, and was replaced by a large excess of widows and widowers. A very large proportion, amounting in the larger towns to one-half, were not natives of the town. They hailed from the agricultural districts and villages. Among adults about a third only belonged to the town, while among the children this proportion was reversed. The universal experience was that towns were growing in excess of their surplus births, and that rural districts were diminishing in spite of an enormous surplus of births. This showed there was a stream of migration from the latter to the former. Taking into consideration the higher birth-rate and death-rate of the towns, he asked if it was pronouncing a harsh judgment to say that the towns devoured their own children and filled their empty places with the country children.

The eight principal towns in Scotland had an annual excess of births over deaths of 13,340, but they increased by 21,760 souls, so that they absorbed every year 8,420 immigrants. Their average birth-rate was 33 and their death-rate 23 per 1,000. The large towns of from 10,000 to 25,000 inhabitants had an annual excess of births over deaths of 5,560, but they increased by 6,106, so that they absorbed every year 546 immigrants. Their average birth-rate was 42 and their death-rate 26½ per 1,000. The small towns from 2,000 to 10,000 inhabitants had an annual excess of births over deaths of 12,174, but they had only increased by 9,384, so that they sent out an annual surplus of 2,790. Their average birth-rate was 32½ and their death-rate only 18 per 1,000. The rural districts had an annual excess of births over deaths of no less than 15,815, but they only increased by 305, so that they sent out a suplus population of 15,510 persons every year. Their average birth-rate was 32 and their death-rate less than 18 per 1,000. The growth of Edinburgh during the ten years preceding last census was supplemented by an annual draft from external resources of 578 persons. In 1881, out of every 100 of her inhabitants only 48 were natives, and 34 had been born in the counties of Scotland, exclusive of the seven principal towns. Of the adolescents (under 20 years of age) 71 per 100 were natives of Edinburg, and of the adults only 31; of the adolescents only 16 hailed from the counties outside the seven principal towns; of the adults 48. In the case of Glasgow it was necessary to include the suburbs to get a true measure of the indebtedness of the entire community to external sources for the increase of her population. They then found that her own birth-product was supplemented by an annual draft of 2,340 persons. The materials for an analysis of the inhabitants of Glasgow and suburbs as to their place of birth were not accessible to him. He must therefore take the artificial Glasgow of the Registrar-General. In 1881, out of every 100 of the population of this "Glasgow," only 51 were natives, 26 came from the counties of Scotland outside the seven principal towns, 13 were natives of Ireland, 5 came from the other chief towns, 3 were of southern origin, leaving 1 to represent the foreign element. Out of every 100 adolescents there were 76 Glasgowegians; among the adults only 31. Among the adolescents only 14 hailed from the Scotch counties, exclusive of the principal towns; among the adults, 37; among the adolescents only 4 were of Irish origin; among the adults, 20; while of the former class 3 were natives of the chief towns and 2 were from over the border, as compared with 7 and 4 respectively of the latter class, leaving in each case a balance of 1 foreigner to complete the 100. These were fair examples of the results of the family arrangements of towns.

A century ago Lord Kames wrote that London was a greater enemy to population than a perpetual bloody war would be. In 1865 Dr. Morgan estimated that in order to maintain the growth of London "the whole available resources of a vast country nursery, peopled by nearly two millions, must be called into requisition." The lecturer did not complain of, and it was futile to oppose, this natural law. What he protested against was that the towns did not rear their own children into healthy and vigorous citizens. They subjected selected country lives to physical conditions which were fatal to child life, and slowly sapped the vigorous rustic constitutions of the parents. As the towns of Scotland extended they had a condition of things extending in which, of every 1,000 children born, 137 died before they had reached their first birthday. As the rural population diminished they had a condition of things diminishing under which only 90 were thus prematurely cut off. But the increase of the principal towns meant the extension of conditions under which 150 out of every 1,000 children born perished within a year of birth. Glasgow was extending most rapidly of all, and she made away with 153 per 1,000 of her children before she had them a year in her fatal arms. A much larger proportion of the English than of the Scotch people lived in large towns, and the large towns of England were much more deadly to child-life than those of Scotland. Within a year of birth they destroyed on an average 185 of every 1,000 born. In Liverpool this proportion rose to 219, and in Leicester to 245, or 1 out of every 4. He next pointed out that if so many children died within twelve months a great number more must be wounded in the campaign, many of whom would die, and the survivors would be invalided. It could thus be shown without statistics of stature, weight, etc., that the physique of town born and bred men and women must be inferior to that of men and women born and bred in the country, and that as the town element increased, the physique of the whole country must be deteriorating. The rural districts furnished the only resistance to this downward progress, and just as the towns absorbed the country inhabitants this resistance would become less and the national descent more rapid.

Now they knew what he meant by the children of the city, and they could estimate the importance of his question, "What can we do for them?" He would confine himself mainly to the physical aspects of childhood. Every element of health which influenced the adult told much more upon the child. The general sanitary improvement of our towns told first and chiefly upon the children, and so with everything affecting the morals of the adult population. The city quickened every element—the bad as well as the good—in human nature. At the root of a high infantile death-rate there were always elements of moral delinquency in the parents, and drunkenness was unquestionably the most potent for evil of all moral factors. He merely alluded to the moral aspect of the case to show that he was alive to it. It was a favorite method of landlords and others to divert attention from one of the many causes at work which happened specially to touch their pockets to another cause which had the commendation that it shifted the burden from their shoulders. It was also a failing of one-eyed, though zealous reformers, to magnify their particular fad, and so aid and abet the numerous class of interested obstructives. Taking the case of a city child, with sober, industrious parents, born in a city fairly well looked after as to general sanitation, what, in a word, was it that such a child still lacked which the country child had, and that it most required? The answer was, space, or room. The larger the city, the hotter the competition for living and working room; and it was hottest in the heart of the city. The element of space comprehended all the physical conditions of health so completely that the name density was recognized by vital statisticians as the best standard of measurement of those conditions in different districts for comparative purposes. Then, as the child grew up, came the natural desire for play and exercise, which was essential for health and growth. Pent up as city children were, their play inevitably became in great part mischief. Policemen and proprietors were constantly stopping their amusements. Dr. Strachan noted that the prevailing characteristics of play corresponded with the manners, habits, and occupations of the adult population. How often did they see the city child playing at being drunk, or at policemen and thieves, or at fighting. Nothing was more pitiful than this compulsory perversion of a natural instinct into unwholesome ways.

He should not pretend to exhaust the resources of benevolence, but he would first warmly commend a system of holiday "colonies," which, originating in Switzerland ten years ago, had spread over the large towns of Germany, Austria, and Italy. Selected, poor, weakly children between the ages of 7 and 14 were sent in "colonies" of from 10 to 40 under teachers, and the month constituting the school holiday was spent at farm-houses or school-houses in the open country. The improvement in health from these outings had been proved not to be temporary. The selected children continued to gain in height, weight, quickness of intellect, and moral improvement beyond their fellows. The cost only amounted to 2s. per day for each child. Anybody who could afford it might engage unostentatiously in this good work by giving a holiday to one or two city children. Dr. Russell referred to a number of institutions for this purpose which exist in the cities of the United States. He also spoke of the National Physical Recreation Society established last year in London. He referred to the establishment of day nurseries, Kyrle societies, the utilization of board-school playgrounds, the throwing open in summer of private gardens and parks, the hiring of play-rooms in poor districts, as hints to the philanthropic. Every large city should have a society such as the Metropolitan Public Gardens Association.

The answer to the question, "What can we do?" referred to the making of cities more like places where children formed part of the population. At present they seemed to have been laid out by some Board of Bachelors, Malthusians, or Herods. Think of the pains expended by breeders of stock upon special arrangements for the young. The city notion was to pack the adults as closely as possible, and then shake the children down into the chinks. There was no place they could call their own; they were in the way both inside the house and outside. He was disposed to believe that if women had had a voice in the legislation children would not have been forgotten. But did any father ever ask a municipal candidate if he would support a proposal to provide play-grounds for children in the ward, or press similar questions bearing on the welfare of the young upon Parliamentary candidates? Wherever the element of space was involved in any proposed legislation, let the people support that which would give them the most space about their dwellings. They would also find the landlords, house factors, and speculative builders on the other side. The people would save the increased taxation in doctor's bills and burial expenses. He exhorted working men to remember that for them the most useful open spaces were those which were close to their houses. He objected to distant parks solely as substitutes for the occasional simple play-ground in the heart of the city. Both together formed a complete provision for the young children as well as for the adults. These parks had chiefly benefited wealthy suburban communities beyond the area of taxation. He praised and commended for imitation by other cities the wisdom of the corporation of Edinburg in providing parks, but also clearing and paving small areas here and there in the dense portions of the city.

THE DETROIT ART MUSEUM COMPETITION.

(From Our Special Correspondent.)

THE trustees of the Detroit, Mich., Museum of Art recently accepted the plans prepared by Architect Balfour, of Hamilton, Ontario, and the local architects are much disturbed in consequence. It is claimed that in November last designs were invited from architects throughout the country, the estimated cost of the structure being $40,000. It is alleged the invitation stipulated that the drawings would "be passed upon by a competent board of experts." Some of the competitors claim that no such board ever handled the plans and that an implied contract and agreement was violated by the trustees in making the awards. There is some talk of carrying the matter into the courts

ASPHALT PAVEMENTS IN LONDON.

AT the annual meeting of the Val de Travers Asphalt Paving Company (Limited) in London the chairman in the course of his remarks, as reported in the *Railway News*, said: "I am happy to tell that within the last few years twenty wood streets have been removed and asphalt has been put in place of wood. And since this report has been issued and put into your hands we have got an order from the corporation to remove another important wood-paved street and to substitute Val de Travers asphalt in its place. It seems to me that the tendency is entirely in this direction, and I believe the prospects with regard to the extension of asphalt are increasing every day. One of my colleagues at the last meeting said that as civilization advances, he believed asphalt would advance."

THE Health Department of St. Louis, Mo., has published a condensed statement of the deaths in that city for the year 1886. The total number of deaths during this period was 8,268, being 778 more than during the previous year. The population of the city is estimated at 400,000, which would give a death-rate of 20.67 per 1,000. There are 719 deaths reported as due to diphtheria.

THE SEWERS AND AQUEDUCTS OF ANCIENT ROME.

OF the series of lectures which Professor Rodolpho Lanciani, Director of Excavation for the city and Province of Rome, is now giving in this city, at the Madison Square Theatre, not the least interesting was that of last Tuesday, on the sewers, aqueduct, baths, cemeteries, and sanitary regulations of the ancient city.

Speaking first of the history of malaria in the Roman Campagna, the lecturer suggested a connection between the healthfulness of the regions in the early history of the city and the volcanic activity which then existed. This was advanced merely as a suggestion to explain the unquestionable fact of the comparative healthfulness and freedom from malaria in ancient times, for which, said the lecturer, no satisfactory explanation has yet been made. As to the city itself, evidences exist of a considerable improvement in its salubrity between the time of the kings and the last century of the Republic, and the cause was to be looked for in the great sanitary works carried out in the city. The first of these considered was the drainage, the first great work generally known being the Cloaca Maxima, constructed in the time of the Tarquins by Etruscan engineers. Lately, however, a still older and larger drain has been discovered of a more massive construction even than the great Cloaca. These great sewers, originally intended to drain the ponds and marshes and carry away the rain, became receptacles for waste-water, and were a cause of nuisance on account of the large street openings, some two feet in diameter, for the admission of street-wash. From these openings the foul air of the drains was admitted to the streets.

The original sources of water-supply were wells, springs, and the Tiber. As the city grew the first became insufficient, and the latter polluted by the wastes of the city. Experiments made on the Tiber recently show that above the city the water is very pure, but below wholly unfit for use. The need of a pure supply of water was recognized in the fourth century B. C., and the first of the conduits, the Appian Aqueduct, was built in the year of Rome 442. This aqueduct brought water from a spring about nine miles distant. One aqueduct after another was built, until under the Empire they numbered fourteen, varying in length from 7½ to 44 miles, with a total length of 359 miles. Of this length 304 miles was underground and 55 miles on elevated structures. The water of two of the aqueducts, being of inferior quality, was used only for irrigation and cleansing. The construction of these great aqueducts was due to the ignorance of the Romans of the use of cast iron. They were without the material for pipes of great size and were obliged to resort to masonry conduits; but they were well acquainted with the principle of the syphon, which was used to carry water across valleys and over hills. The lecturer cited some notable cases of the use of lead syphons for the supply of private villas. Artificial reservoirs, formed by damming across valleys, were constructed by the Romans, and some great feats of tunneling were performed by them in bringing water to their cities. The report of an engineer on the tunnel built to bring a supply of water to a city in northern Africa is still extant, and it is there related how, through an error of the contractors, in the absence of the engineer, the two headings, starting from opposite sides of the mountain, failed to meet; how the engineer corrected the mistake, brought water to the city, and erected an altar bearing an inscription setting forth the history of the work, and his own freedom from any responsibility for the failure of the tunnels to connect. Another tunnel near Rome, constructed in the reign of Domitian, is 4,950 yards long. Great difficulties were encountered in ventilating it, and the contractor on its completion erected a votive temple to denote his gratitude to the goddess for the protection granted to his undertaking.

Professor Lanciani's description of the tombs and cemeteries and sanitary regulations may be more briefly summarized. The original mode of disposing of the dead was by burial. This was succeeded by cremation, and this again, under the influence of Christian ideas, was succeeded by burial. The wealthier Romans built their own private tombs, often at great cost; the poor formed clubs or societies to erect common vaults for their ashes (*Columbaria*), while the very poor were pitched promiscuously into pits, in what would correspond to our pauper burial-ground. The city's garbage was piled in the same pits, and a nuisance arose, which the city authorities, at various times, sought to abolish. The common dead were also thrown into the ancient moat around the wall of Servius Tullius, where thousands of corpses were disposed of. The lecturer related a remarkable case, where, in excavating for a house a few years since, the ground suddenly gave way, and a pit thirty feet deep was disclosed. This proved to be a part of the old moat, which had once been filled to the top with carcases and refuse, and these suddenly turning to dust on the admission of the air, the apparently sound earth had given way.

The want of anything like hospital organization in the early city was noted; the establishment of the Temple of Esculapius, on Tiber Island, which became a shrine for the diseased, was mentioned (the island still the site of a hospital), and the later establishment, by law, of a health organization in all towns and villages was touched upon, when, for want of time, the lecturer was forced to close.

Many stereoptican views were shown, and the whole was very interesting.

ENGINEERS' CLUB OF PHILADELPHIA.

AT the regular meeting March 19, 1887, President T. M. Cleemann in the chair, Mr. Howard Murphy, the Secretary, presented for Mr. Wilfred Lewis the following note upon phosphor-bronze wire for helical springs.

"For a given load it was found that the extension of the bronze spring would be just double the extension of a single steel spring—that is, for the same extension the steel spring is twice as strong."

Mr. John L. Gill, Jr., presented a paper on screw-threads.

"The Franklin Institute appointed a committee which reported December 15, 1864, and recommended that the system of screw-threads presented by Mr. William Sellers at a previous meeting should be universally adopted throughout the country.

"The engineers of the army and navy, the associations of the master car builders and master mechanics of the railroads, and many of the most prominent manufacturers, adopted this system.

"The members of the two associations above referred to appreciated better than any other class of mechanics the importance of an interchangeable system, for they have to furnish nuts and bolts to replace those lost or damaged on cars of foreign roads (so called) while in use on the railroads which they have charge of.

"It has been found that while all the roads use the Institute system as regards to the number of threads, but very few of them conform to the standard in other respects. Most of them use taps considerably over size, and some do not use the flat top and bottom; some never did use it, while others after adopting it abandoned it, finding it almost impossible to keep them up to standard owing to the great wear on the taps and dies.

"The specimen exhibited showing the different threads and the drawing presented illustrate more fully the different values than any description that could be given.

"I am under the impression that car-bolts and bridge-rods, having the new threads, without upsetting, would be better than rods of the same size, with upset ends, having large nuts on, and the Franklin Institute threads; for it is impossible to heat a rod in a smith fire without the risk of injuring the iron by overheating, and, in upsetting, the fibre of the iron is so distorted as to reduce the strength of the rod very materially.

"Besides, the holes made in the timber or iron through which the rods have to pass, do not have to be made any larger than the bolt, while in the size above referred to the holes have to be increased 25 per cent., thereby greatly reducing the strength of the supported member.

"I am of the opinion that a different thread from that now in general use should be adopted for car and bridge building."

Mr. H. H. Sintzenich, introduced by Mr. Henry G. Morris, exhibited and described a rail-chair which he had devised with a view of overcoming the objections to joints bolted through the webs of the rails, and of obviating the necessity for brace or check-blocks on curves.

The Secretary presented for Mr. F. H. Lewis a paper upon the Clapp-Griffiths steel for structural work.

The Secretary presented for Mr. Emile Low a paper upon maps for railroad surveys, wherein Mr. Low recommends the use of separate sheets, 19x24 inches, which on the scale of 200 feet to 1 inch, which he prefers, would each embrace about one mile of the road.

THE ASHES AND GARBAGE NUISANCE IN NEW YORK.

THE collection of ashes in this city has always hitherto been attended with nuisance. We are, therefore, glad to see that President Bayles, of the Board of Health, has made one of his first acts an attempt to abate it, with the co-operation of Commissioner Coleman, of the Department of Street-Cleaning. The latter will establish an experimental district for night collection of garbage and ashes. The ash-cans are not to be put on the sidewalk, as has been the custom, but they are to be placed in the areaways, to be taken from there by the cartmen and returned there. If the experiment demonstrates the practicability of the system it is to be extended to other parts of the city. At any rate, it seems likely that the Departments of Health, Street-Cleaning, and Police are going to make a serious effort to abate one of our local nuisances.

THE New York City Board of Health last week Tuesday adopted a resolution to secure better lighting and ventilation of tenement-houses. It is as follows: "No plan for light and ventilation of a tenement-house with apartments on five or more floors and having more than twelve rooms on a floor to be erected on an ordinary city lot, except a corner lot, will be approved where more than sixty-five per cent. of the lot is to be covered, unless the courts to light and ventilate the interior rooms thereof shall have an area of at least 265 square feet; and where there are to be only twelve rooms on a floor the area of such courts must be not less than 215 square feet.

MODERN ARCHITECTURAL PRACTICE.*

IF American architects have contributed anything new to the cause of good architecture it is in the domain of country houses. It may justly be claimed that we have done something in the development and new application of Byzantine and Romanesque forms in our public buildings, but even though this be disputed by our foreign critics they admit that in country houses we are in the van. Mr. Price's admirable preface gives a fair notion of the reasons that have brought about this gratifying state of things, and the following pages, consisting of twenty-four large, well-executed plates, showing perspectives, plans, elevations, and details of a thoroughly well-designed house, present still further evidence why architects in general, and Mr. Price in particular, have achieved success in this branch of work. Besides the plates there are specifications for the different parts of the work which are suggestive.

The publisher is to be congratulated on the inauguration of this series of books, and if the succeeding numbers keep to the same high standard they will form a valuable acquisition to the library of the professional man and builder.

TRANSACTIONS OF THE SANITARY INSTITUTE OF GREAT BRITAIN. Volume VII. 460 pp., 8vo. London. 1886.

This handsome volume contains the Proceedings of the Institute for 1885, including the papers and discussions of the meeting at Leicester in September of that year. Leicester is one of the English towns in which for some years the average annual mortality from infantile diarrhœa has been much above the average, and hence the paper on this subject by Dr. Buck, with the discussion which followed it, is of special interest. Dr. Buck is inclined to think that the disease is due to one or more forms of micro-organisms which flourish and multiply especially during high temperatures and in low-lying, badly-drained localities. In the discussion which followed impurity of the subsoil was also insisted on as one of the specially efficient causes which was present in Leicester. It will be observed that these conditions are the same as those which have been found to favor the spread of phthisis, and in reply to a question on this point Dr. Buck said that "he should think they could hardly find a town in England where consumption was more prevalent among children than in Leicester."

In this connection should be read the paper by Mr. John Underwood on "The history of sewerage and sewage treatment at Leicester." The plan for sewerage and sewage disposal for Leicester were made and carried out by Mr. Wicksteed, and it was one of the first places at which chemical precipitation of sewage to secure a reasonably pure effluent was systematically carried out. The

* Modern Architectural Practice. No. 1. A Large Country House. Bruce Price, architect. New York: W. T. Comstock, publisher. Price, $5.

results have not been altogether satisfactory. The expected profit from the sale of manure has not been realized, and the result has shown that the main sewers were too small, so that there has been cellar-flooding during heavy rains. Evidently the time has come when the system must be radically changed.

One of the most valuable papers in the volume is by Mr. J. Gordon, C. E., on "The drainage of continental towns." This is a clear, condensed summary of what has been done in over thirty of the chief European cities, and should be read by every sanitary engineer.

Another important paper is the address by Dr. Marset, the President of the Section of Chemistry, Meteorology, and Geology, "On the distribution and object of carbonic acid in nature and its sanitary relations," and "On the influence of altitude on the chemical phenomena of respiration."

Mr. Ernest Hart's lecture on "The essentials of local government reform" gives a very good idea of the difficulties which lie in the way of systematic and uniform sanitary legislation for an old country like England hampered with vested interests of all sorts. The fundamental difficulty at present is to obtain satisfactory units of area as a basis for organization, for none of the present units are what are needed, and until this is done sanitary legislation must be more or less patchy and scrappy.

Mr. Snell furnishes a paper on "Circular hospital wards," in which he objects to them chiefly on the ground of expense, and Captain Galton contributes an address to the working classes to show that "prevention is better than cure." Want of space forbids further notice of these or of several other papers of interest.

HEATING RAILWAY-CARS.

THE New York State Railroad Commissioners last week presented to the State Assembly Railroad Committee a supplementary report on the car-heating problem.

The report says that facts now in possession of the board demonstrate that doubts as to the practicability of heating either by steam from the locomotive or from a separate car are fast being dissipated. Serious objections have been shown to any form of safety car-heater inside of or attached to a car. If so constructed as to withstand the shock of collision they have to weigh from 600 to 800 pounds, as the board observed at a test which it attended, and thus they might inflict personal injury in cases where cars are overturned or rolled down embankments. Their weight and momentum might also cause very serious results to passengers in collisions and other accidents accompanied by a severe shock. They are to be dreaded even where water bases or other fire-extinguishing devices are used. Should an accident happen, as it well may, at the moment that a heater is open to receive coal or to be otherwise tended, or when carelessly left open, the present danger of setting fire to the car would be added to those caused by its weight and momentum.

All the improvements thus far proposed in the car-stove to a greater or less extent simply reduce the percentage of risk, but do not eliminate it. There seems to be no way absolutely to get rid of the dangers incident to the car-stove, unless abolishing it entirely. Again, these safety-heaters cost from $200 to $300 per car as is reported by the board, were the best of them to be extensively adopted. It appears that rapid strides being made towards heating from the locomotive will soon force the substitution of that method as the safer and cheaper, and thus a large expenditure would have been made in a mistaken direction. Since the tendency of invention and of experiments by railroads seems to be towards heating from the locomotive, and since that method promises greater security to the traveling public, it is thought best to urge that all efforts to accomplish the needed reform be made in that direction rather than divided between expensive safety-heaters, which must ultimately be done away with, and methods of independent steam or hot-air heating.

Having determined, therefore, that it is best to endeavor to abolish car-stoves and heaters, and to require that steam or hot air shall be used from the locomotive or from an independent car, the next question is, how far ought legislation to go at the present time? "We must bear in mind," say the commissioners, "that the traveling public will insist upon having the cars kept warm, especially when the outside temperature is from zero downwards. This leads us to consider what inventors call the 'state of the art' of steam-locomotive heating. The system has been practically tested to an extent that warrants us in saying that under all ordinary circumstances it can be adopted by railroads upon trains of from three to seven cars without serious apprehensians of failure from the following causes: (1) The inability of the engine to furnish steam enough. (2) The danger of freezing at the couplings between the cars on account of the collection of water where the pipes settle below a level, and also in the traps which are necessary on any system of heating using steam-pressure. While the latter danger cannot be said to have been entirely obviated in very severe weather, yet we do not run much risk in assuming that mechanical improvements to be made and care to be exercised by employees will in the course of another winter give us reliable results in this respect.

"Whether our long trains of from ten to fourteen cars can be heated satisfactorily by steam, is a serious mooted question. It has not been done at all even under favorable conditions. Under the directions of the board, its inspector asked in each case of engineers and master mechanics, 'With a train of twelve or fourteen cars and the engine working her full power, could you, without detriment to your engine or loss of time, heat your train with steam from your boilers?' He reports that the answer was almost universally, 'We believe we can, but perfer actual experience before saying much on that subject.' Each inventor and his friends insist that it can be done under his system, and hence that failure to adopt that system at once is almost criminal."

The report is signed by Commissioners Kernan and O'Donnell. Commissioner Rogers submits a minority report, the main feature of which is that he dissents from the opinion of the main report so far as it tends toward making it mandatory on railroads to substitute steam-heating for stoves, for the present at least.

REGARDING THE STUDY OF ARCHITECTURE.

WE have received several letters in response to inquiry on the above subject, published in our last issue, page 431. An opinion was asked on the following point with reference to a college graduate:

"Is it best for a young man desiring to study architecture to graduate at some technical school affording instruction in that branch before entering an architect's office, or should he see something of the practical side of the subject in an office before attending such a school? What schools in the United States give thorough and adequate courses of instruction in architecture?"

We quote from some of the different suggestions received, reserving some for our next issue for want of space, as follows:

Professor William R. Ware, of the School of Mines, Columbia College, writes:

"Of course a young man gets on further in an office for having been trained in a school, and profits more by his schooling for having acquired some skill in office-work.

"Accordingly, I suspect that the offices would advise going first to the schools and the schools to the offices. Both naturally prefer a fellow who knows something already.

"But I suspect also that young men more often find their first year unprofitable through lack of suitable preparation when they spend it in work than when they spend it in study. For the methods of schools are expressly adapted to meet the needs of the students they admit to their classes, while the conduct of offices is necessarily controlled by quite a different class of considerations. Moreover, the things learned in school are more pertinent to office-work than office methods are to school work.

"Which course is best for any given person depends on what he is and what he comes from. A boy who has got tired of books may be greatly profited by a change. But even in such cases the change from academic to professional study is often sufficient for the purpose, as is notoriously the case in the schools of law and of medicine, where men who have idled in college are often among the most devoted and enthusiastic students.

"Experience seems to show that a young man who spends two or three years in a school, and then two or three years in an office, has then as good a position as if he had spent the whole time in an office, which can hardly happen if he takes his office-work first. For in one case the time spent in an office is at the bottom of the ladder, in the other at the top. But if a boy is too young for serious work he had better waste a year or two in an office than in a school. It will be easier to make up for it later.

"In practice the choice is not as absolute as the question would imply. In the long summer vacations a young man can generally get a sufficient notion of office-work to give point to his school work, without interrupting or deferring it."

Mr. E. M. Wheelwright, of Boston, writes:

"I consider one or two years' study in some architectural school *before* entering an architect's office to be the best course for the graduate of a college intending to study architecture.

"This course will give him a knowledge of styles and architectural forms that he cannot gain as readily in an architect's office.

"It is by no means essential that the student should take the regular course and be a candidate for a degree.

"Indeed, I consider it better for an earnest man who has had a college training to take a special course in architecture, where such a course is offered."

Mr. C. H. Blackall, of Boston, writes:

"If the young man is thoroughly in earnest, and willing to work hard and make the most of every opportunity, his best plan would be to enter one of the regular architectural schools, following the complete course, and spending his vacations in the office of the best New York or Boston architect who will consent to receive him as a pupil. After completing the four years' course in architecture, let him spend not less than two years as a draughtsman in some good office, and then, if his ambition holds out and his means permit, study two years in the Ecole des Beaux Arts, Paris, and travel a year in Europe. But if he is not a hard worker, or has merely a general liking for the profession, it might be well for him to take first a year's experience with an architect, after which he would probably appreciate the need of thorough training, and would be willing to follow the programme previously stated."

Professor N. Clifford Ricker, of University of Illinois, Champaign, Ill., writes:

"There seems to be no valid reason why a student of architecture should first obtain some knowledge of the practical work of the profession, afterwards proceeding to acquire his technical education and training. Indeed, there are many which prove that the reverse of this method is most advisable, just as in any other profession.

"Otherwise (1) he would be useless and in everybody's way in an office without some knowledge of construction, of architectural drawing, and of details.

"2. A busy architect, in good practice, has no time to teach draughtsmen or pupils.

"3. It would not be worth while for the student to enter an office where the principal has abundant leisure.

"Assuming that a young man really desires to acquire a thorough knowledge of architecture, possesses fair abilities and sufficient means, the best preparation for his profession would be the following, in my opinion:

"1. To attend a good architectural school, completing the entire course of study as prescribed, without attempting to get through a four years' course in three, or to combine architecture and some branch of engineering, etc.

"2. A post-graduate course of a year would give him an opportunity for a more extended study of various essential things, which cannot be fully developed in the ordinary undergraduate course, or for the further study of such specialties as may be particularly attractive to him.

"3. When the junior vacation is reached, the young man will have acquired sufficient technical knowledge and power in design, if he have any genius whatever for architecture, that he will be of real value in an office, and would not be kept at tracing, inking, and similar mechanical work. This vacation would give him three months' practice; if spent in a good office, it would make an excellent preparation for the last year of his course of study.

"4. After graduation from the school, he should spend two or three years in several of the best offices in one or more large cities; it would be preferable to not remain more than a year in any office or city, so as to obtain a more extensive knowledge of the varying practice in different parts of the country. During this time he should join the local architectural clubs, and make use of all available means for cultivating his skill and power in design.

"5. Then let him spend one, or better two, years in foreign travel, sketching, making collections of photographs, books, as well as novel ideas in construction and ornamentation, that he believes will be useful in his future practice. It would also be beneficial for him to write out his observations for publication in one of the architectural journals, for this will improve his power of seeing things and of describing them, affording some literary training, too frequently neglected by practicing architects.

"This would be far preferable to spending the same time in attendance at a foreign architectural school, for a limited course of study there is of but little practical benefit to an American, so much of the instruction is entirely unavailable in this country.

"6. On his return to this country, if the young man has a real call to the profession of architecture, he will be prepared for a fine position as manager of a first-class office at a large salary, or to go into practice on his own account, as he may prefer, with a professional training much excelling that possessed by nineteen-twentieths of the architects now enjoying a fair practice.

"If the means of the student were limited, the year of post-graduate study and the European tour would necessarily be omitted."

PERSONAL.

COLONEL P. C. HAINS, U. S. Engineers, has been detailed to take charge of the construction of the new bridge over the Eastern Branch of the Potomac River, at Washington.

THE Boston Water Board has appointed Messrs. L. Frederick Rice, Charles Carr, and Nathaniel M. Lowe as committee of experts to conduct the water-meter tests that have been instituted and were referred to in our last issue.

LIEUTENANT A. G. WINTERHALLER, U. S. N., has been designated to attend the Astronomical Congress at Paris this month.

JAMES M. OAKLEY, President of the Woodhaven and Rockaway Railroad, died at Jamaica, L. I., March 25. Mr. Oakley was an Ex-State Senator of this State.

MR. DAVID MCCOMB will be engineer of the new Sewer Department of the District of Columbia.

MESSRS. FULLER & WHEELER, of Albany, have been selected as the architects of the new opera-house at Newburg. The building will be 85x140 feet, four stories high, of stone, brick, and terra-cotta. The award was made to Fuller & Wheeler in competition with several other architects.

MR. JOHN PRAGUE, architect, of this city, who has been located at No. 47 Bible House, removed, on March 26, to the Prague Building on the south-east corner of Broadway and Forty-fourth Street.

CONVENTION OF NATIONAL ASSOCIATION OF BUILDING TRADES.

(From our Special Correspondent.)

CHICAGO, ILL., March 29.—The National Association of Builders began their first annual convention this morning at the Grand Pacific Hotel. The convention was called at a preliminary meeting of builders in Boston last January, when a Committee of Arrangements was appointed consisting of William H. Sayward, Boston; John S. Stevens, Philadelphia; Thomas J. King, Washington; J. Milton Blair, Cincinnati; George C. Prussing, Chicago. The object of the gathering, while varied, is largely to act upon the labor question, and the spirit of the delegates showed itself unmistakeably in an incident which happened directly after the opening, when George Weaver, of Indianapolis, suggested that Henry George, who was in the city, be asked to speak. A perfect storm of hisses followed this.

George C. Prussing, as Chairman of the Executive Committee, called the convention to order and, after fitting words of welcome, proceeded: "You are sent here to lay the foundation of an edifice which when completed will bear witness, we trust, to the business tact, moderation, and wisdom of its founders, and be of benefit to all, not only to those whom we more directly represent—the builders—but also to the mechanics and laborers engaged in the various building trades and in the shaping and preparation of building materials. And as everybody is, or expects to be, a builder at some time of his life, the results of your labors will affect all directly or indirectly, immediately or remotely."

Mr. Prussing, on nomination of J. S. Stevens, was unanimously elected permanent chairman, and said they were met to secure uniformity of action in the relation of builders to owners, architects, dealers, and employees. W. H. Sayward was chosen Secretary, on nomination of J. Milton Blair, and appointed as his assistants, William Harkness, Jr., of Philadelphia, and J. Arthur Jacobs, of Boston. On report of the Credential Committee the following delegates, about 150 in number, were seated: A. J. Campbell, A. G. Bogert, John Byrnes, John McGlensey, Marc Eidlitz, John J. Tucker, New York City; Leander Greeley, Ira G. Hersey, John A. Emery, Wm. Lamb, J. Arthur Jacobs, Francis Hayden, Wm. H. Sayward, Boston; E. B. Crane, O. W. Norcross, Henry Mellon, O. S. Kendall, Robert S. Griffin, Geo. S. Cutting, Worcester, Mass.; Geo. R. Phillips, Richard Hayward, Geo. S. Ross, Providence, R. I.; David M. Alexander, Albany; C. A. Meeker, Troy, N. Y.; Chas. W. Voshell, Rochester, N. Y.; Chas. Berrick, John Feist, Chas. A. Rupp, Buffalo; John S. Stevens, Chas. H. Reeves, D. A. Woelpper, Geo. Watson, W. Harkness, Jr., Geo. Roodhouse, Wm. Gray, Philadelphia; Geo. A. Cochran, Samuel Francis, Alex Hall, R. C. Miller, Geo. S. Fulmer, Pittsburg and Allegheny City; John Trainor, John J. Purcell, John G. Hetzell, Wm. Anderson, Wm. Ferguson, Philip Walsh, Geo. Mann, Baltimore; D. A. J. Sullivan, Henry Oliver, Charleston, S. C.; Daniel S. Wright, Nashville, Tenn.; A. J. Muir, H. Hofield, F. H. West, New Orleans; J. Milton Blair, L. H. McCammon, J. Graveson, James Allison, H. L. Thornton, J. C. Harwood, William Schuberth, Jr., Cincinnati; Thomas Simmons, H. Kickheim, John T. Watterson, S. W. Watterson, Cleveland; George B. Parmelee, Columbus, O.; John Martin, J. C. Adams, Fred Mack, G. Weaver, C. Binder, William P. Jüngelaüs, Peter Raütier, Indianapolis; Thomas Fairbairn, W. E. Avery, W. J. Stapleton, James Locke, W. G. Vinton, Detroit; John Rawson, James Curtis, H. E. Doren, J. D. Birland, C. H. Pelton, W. C. Weatherly, C. A Sathren, Grand Rapids, Mich; Thomas Mason, Garrett Dunck. John Langenberger, Richard Smith, Milwaukee; Edward E. Scribner, J. B. Chapman, E. F. Osborne, G. J. Grant, J. H. Donahue, J. S. Burris, J. W. Gregg, St. Paul; Thomas Downs, F. B. Long, H. N. Leighton, George W. Libby, Herbert Chalker, F. S. Morton, Minneapolis; Fred F. Beck Sioux City, Iowa; Andrew Kerr, H. C. Lindsley, John R. Ahrens, John H. Dun'ap, Anton Wind, Richard Walsh, William Gahl, St. Louis; George Tapper, P. B. Wight, George C. Prussing, William Grace, F. V. Gindele, Alexander W. Murray, J. B. Sullivan, Chicago. Alternates were given seats without votes. A telegram of greeting was received from Pittsburg in the name of twelve hundred master house-painters of the United States and signed Titus Berger, President.

In the afternoon, after the appointment of various committees, Mr. Harkness, on behalf of the Philadelphia delegation, presented the following:

Whereas, The old system of binding apprentices to the different trades has practically fallen into disuse, and recognizing the fact that the future advancement of the mechanic demands that some action should be taken on the subject—

Resolved, That a uniform system of apprenticeship should be adopted by the various mechanical trades; that manual training-schools should be established on a part of the public school system; that trade night-schools should be organized by the various local trade organizations for the benefit of apprentices.

Mr. John J. Tucker, for the New York delegation, offered the following;

Whereas, Owing to the frequency of accidents to our employees and others, occasioned largely from a want of sufficient safeguard, thereby endangering the lives of those employed upon our works, and increasing our responsibilities—

Resolved, That it is the sense of this body to invite the co-operation of architects and builders to embody in their specifications such requirements as shall most effectually lessen the danger, by making it obligatory for the builder to cover the entire surface of each tier of beams when laid by fitting same with floor arches where beams are of iron, or by laying the rough floor of wooden beams, or in some other effective manner when either of the above is not required.

Marc Eidlitz, also for the New York delegation, offered the following:

Whereas, It is well known that those employed in the different branches of the building trades are more or less subject to being injured upon the works—

Resolved, That we suggest and recommend the formation of life and accident insurance funds for the benefit of our employees.

Also, that we appoint a committee to consider and prepare a plan in conference with competent insurance authorities covering: (1) A plan of insurance for workmen against injuries by accident, the employees to participate in the payment of the premiums in favor of their employers. (2) A plan for securing the payments of annuities to workmen who may be permanently disabled through injuries received by accident or through the infirmities of old age. Upon the report of the committee and the approval of the same by this association, it shall be recommended for adoption to all its affiliated bodies.

For the oston delegation W. H. Sayward offered the following:

Resolved, That this association affirms that absolute personal independence of the individual to work or not to work, to employ or not to employ, is a fundamental principle which should never be questioned or assailed; that upon it depends the security of our whole social fabric and business prosperity, and that employers and workmen should be equally interested in its defense and preservation.

Resolved, That while upholding this principle as an essential safeguard for all concerned, this association would appeal to employers in the building trades to recognize that there are many opportunities for good in associations of workmen, and while condemning and opposing improper action upon their part, they should aid and assist them in all just and honorable purposes; that while upon fundamental principles it would be useless to confer or arbitrate, there are still many points upon which conferences and arbitration are perfectly right and proper, and that upon such points it is a manifest duty to take advantage of the opportunities afforded by associations to confer together to the end that strikes, lockouts, and other disturbances may be prevented. That when such conferences are entered into, care should be taken to state clearly in advance that this fundamental principle must be maintained, and that such conference should only be competent to report results in the form of resolutions of recommendation to the individuals composing the various organizations participating, avoiding all forms of dictatorial authority.

Resolved, That this organization earnestly recommends to its affiliated associations to secure as soon as possible the adoption of a system of payment, "by the hour," for all labor performed, other than "piece-work," or "salary work," and to obtain the co-operation of associations of workmen in this just and equitable arrangement.

A. J. Campbell, of New York, offered a voluminous preamble and resolutions upon the subject of labor and capital, pronouncing in favor (1) of law and order; (2) the right to choose and follow one's own vocation; (3) protection of capital and labor alike; (4) "appeal to reason beyond force;" (5) and "the encouragement and promulgation of a well-devised plan" to abate or destroy the unfortunate hostile feelings at times existing between employers and employees, so that all may reap the reward of industry and skill, and "that not any, be they sluggards or drones, may prey or fatten upon the fruits and labors of the honest industrious men of work.

All resolutions were referred without discussion to the committee thereon—consisting of W. H. Sayward, J. J. Tucker, William Harkness, Jr., James Allison, and George B. Parmelee—and after considerable debate the Chair decided that the committee had power to digest and report, the convention at the same time having the reserved right to call for original resolutions and to act as it saw fit.

At night the delegates were given lunch and an informal reception at the Builders' and Traders' Exchange, No. 159 La Salle Street.

THE delegates from the various local associations met in Chicago to organize the National Association on the 29th inst. Officers were elected as follows: President, J. Milton Blair, Cincinnati; First Vice-President, John S. Stevens, Philadelphia; Second Vice-President, Edward E. Scribner, St. Paul; Secretary, William H. Sayward, Boston; Treasurer, J. J. Tucker, New York City.

BOSTON PUBLIC LIBRARY ARCHITECTURAL COMPETITION.

A SPECIAL dispatch to the New York *Evening Post* says:

"The architects of this city are angry. The general supervision of the erection of the proposed new public library building devolved upon the trustees of the Public Library, W. W. Greenough, S. A. B. Abbott, H. W. Haynes, the Rev. James Freeman Clarke, and Councilman William Whitmore of Ward 12, and being a city building, it was thought that its construction should be under the control of the City Architect. The latter prepared some plans, which, by those competent to judge, were said to be excellent; but in order to give outside architects an opportunity to offer plans also, the trustees decided upon a competition, and offered $10,000 in prizes. Different plans were secured, but none, apparently, were satisfactory to the trustees. On March 10, a bill empowering the trustees to have control of the design and erection of the building, and to select such an architect as they chose, became a law. It was passed, it is claimed, largely through the influence of the Boston Society of Architects.

"Yesterday Messrs. Greenough, Abbott, and Haynes, of the Board of Trustees of the Public Library, held a meeting and voted to employ as architects for the new building the firm of McKim, Mead & White, of New York City. When the action of the trustees in selecting a New York firm of architects in preference to one in Boston became known, there was much surprise, and in some cases indignation expressed here. Many of the well-known architects of this city say that for one thing the selection is unfair, because many of the best architects of Boston did not enter the contest, as they were unwilling to prepare plans which were to be carried out under the direction of some one other than the architect or architects who made them. They say that there are just as good architects in Boston as in New York. Messrs. Greenough, Abbott, and Haynes, of the Board of Trustees, explain that their action does not imply incompetency on the part of any Boston architect, but that the board wanted the best architects that could be found, and they think they have got them."

PHILADELPHIA MASTER BUILDERS.

AT the meeting of the Master Builders' Exchange on March 22, some thirty new names were proposed for membership and were referred to the proper committee. No special business was done, except the election of delegates to the Chicago convention. They are as follows: Frederick F. Myhlertz, Henry K. Coulomb, William Harkness, Jr., George Watson, David A. Woelpper, Charles H. Reeves, and John S. Stevens. The alternates are William Gray, George W. Roydhouse, W. B. Irvine, Stacey Reeves, Charles Gillingham, W. H. Albertson, and W. C. McPherson.

TRADE CATALOGUES.

MESSRS. W R. OSTRANDER & CO., 21 Ann Street, New York, have sent us a copy of their new catalogue, illustrating and describing the various styles of speaking-tubes, oral, electric, mechanical, and pneumatic annunciators, bell-hangers' hardware, etc., manufactured by them.

THE BOSTON BLOWER CO., 276 Franklin Street, Boston, Mass., have sent us their 1887 catalogue illustrating and describing blowers, fans, shaving-exhausters, etc., manufactured by them, to which is added some useful tables.

PUBLICATIONS RECEIVED.

THE SANITARY CODE OF THE CITY OF PATERSON, N. J., adopted by the Board of Health February 8, 1887, and the rules adoped March 8, 1887. Pamphlet, 29 pp.

SEVENTEENTH ANNUAL REPORT of the New Bedford (Mass.) Water-Board. December 31, 1886. Illustrated pamphlet, 82 pp. R. C. P. Coggeshall, Superintendent.

TWENTIETH ANNUAL REPORT of the City Engineer of Boston, Mass., for the year 1886.

TWELFTH ANNUAL REPORT of the Board of Commissioners of Department of Parks for the year 1886.

THE DOCTORATE ADDRESS delivered at the semi centennial anniversary of the University of Louisville, March 2, 1887, by David W. Yandell, M. D., Prof. Surgery.

REPORT OF THE SEWER COMMITTEE OF THE CITY OF SCHENECTADY FOR THE YEAR 1886. William B. Landreth, C. E., City Surveyor, Inspector of Sewers.

SANITARY EXAMINATIONS OF WATER, AIR, AND FOOD. By Cornelius B. Fox, M. D., F. R. C. P., Lond. 563 pages, 110 illustrations. Philadelphia: P. Blakiston, Son & Co.

FIFTEENTH ANNUAL REPORT of the Superintendent of Water Works, Bay City, Mich. Bay City *Tribune-Press*.

THIRTEENTH ANNUAL REPORT of the Board of Water Commissioners of the city of Springfield, Mass., to the City Council, for the year 1886. Springfield, Mass.; Weaver, Shipman & Co., Printers.

SIXTEENTH ANNUAL REPORT OF THE WATER COMMISSIONERS OF THE CITY OF POUGHKEEPSIE for the year 1886. C. E. Fowler, Superintendent.

SIXTEENTH ANNUAL REPORT OF THE TRUSTEES OF THE CITY HOSPITAL OF THE CITY OF WORCESTER for the year ending November 30, 1886. Dr. Charles A. Peabody, Superintendent.

BUILDING INTELLGENCE.

(Continued from page 448.)

NEW YORK CITY—Continued.

607 Hudson st, ten and store; cost, $12,000; o, Elizs Voorhees; a, F T Camp.

744 9th av, br flat and store; cost, $19,000; o, Maurice Freund; a, Schneider & Herter.

219–221 E 23d st, 2 br flats and store; cost, $44,000; o, John Fish; a, Schneider & Herter.

58–62 Broadway and 21–29 New st, Stock and Pet Ex; cost, $325,000; o, St and Pet Ex; a, Ed Lindsey.

West st, ft Leroy st, br storage; cost, $22,000; o, N J Steel & Iron Co.

409 W 35th st, brick flat; cost, $19,000; o, Thomas Cockrall; a, O Wirz.

N s 154th st, 100 ft w Elton av, br ten and store; cost, $10,000; o, Michael Bramfield; a, M J Garvon.

E s First av, 99 e 100th, 31 br tens; cost, $434,000 all; o, Wm S Middleton; a, Geo W Da Cunha.

S s 73d, 100 w West End av, 19 br dwells; cost, $247,000 all; o, Chas T Mett; a, Wm Merritt.

Continued on Supplement.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 19. PUBLISHED EVERY SATURDAY.

NEW YORK, APRIL 9, 1887.
LONDON, APRIL 23, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

SELECTION OF THE ARCHITECT OF THE BOSTON PUBLIC LIBRARY.

THE position of the members of the architectural profession in Boston on the matter of the selection of Messrs. McKim, Mead & White, of New York, as the architects of the new Public Library Building for that city is made clear by a communication from a reliable correspondent elsewhere in this issue. From this it will be seen that the dispatch to the New York *Evening Post*, which we quoted last week, while having a basis of fact, did really, so far as the profession in general was concerned, give a false impression.

Though we published it as current news, we were loth to believe that the architects of Boston would endorse such a narrow policy as that implied in the idea that only a Boston man should be employed as the architect of a Boston building. There was more or less talk of this character in New York when Messrs. Peabody & Stearns, of Boston, were selected as the architects of the Union League Club Building, but we are sure such sentiments are seldom harbored by the progressive men of the profession anywhere, and least of all are they likely to find encouragement in Boston, since her architects have found clients in all parts of this great country as a natural result of their creditable work.

That the Boston city authorities and the legislators of Massachusetts have recognized the proper limitations of the work of such an official as a city architect, and have held that no obstacle should be left in the way of the utmost freedom of choice, by the trustees, of an architect of a building of such monumental character as this library will be, speaks well for their intelligence and appreciation of architecture as a profession and an art. And that when full power of choice was given the trustees they should have shown that no personal or local consideration swerved them from the plain duty of their trust to select for the work the architects in their opinion best fitted for the successful accomplishment of their purposes, is unhappily very remarkable, yet it is worthy of distinctive commendation.

The trustees are to be congratulated on the nerve and boldness displayed in their action, since there is every probability that the selection of an architect to work out this special problem is likely to secure much more satisfactory results than could come from any competition under the circumstances.

RAILROAD BRIDGES IN NEW YORK STATE.

WE are glad to see that the Railroad Commissioners in New York have been working systematically to find out the weak bridges on the railroads of the State.

The systematic examination of every structure by drawings and properly-worked out strain-sheets is the only sure guide. This work has been progressing since 1884, and has now gone so far that the resulting volume is nearly ready for issue, although it is doubtful if this can be done in time for submission to the present Legislature.

It is a pity that such important matters could not be made accessible to the public as the work progresses, so that the information obtained may be made immediately available. This could be done by a publication in pamphlet form of each portion as completed, and after proper submission to the authorities, its sale or issue to such as are interested. A final publication by bound volume can then be made of the whole. This is the method now pursued by the Secretary of War, in publishing reports from the United States Engineers, and it is a great convenience to the engineering public.

The Commissioners are to be heartily commended for the good example set in this vitally important matter, and every State should speedily follow it by instituting a similar investigation. Moreover, since there is a continuous increase in the loads brought upon bridges, after once making sure of their safety, it is imperatively necessary that a competent person have supervision of them, and be made responsible for their periodic examination.

The Pensylvania road and other roads find an annual examination a necessity, and surely there will be constant employment for at least one person in supervising the railroad bridges of a State.

THE ICE-SUPPLY OF NEW YORK.

THAT ice cut from water rendered impure by sewage contamination may be dangerous to those who drink water or milk in which it has been dissolved has been known for some years. It has also been shown by culture methods that while the vitality of some bacteria in water is diminished or destroyed by freezing, yet that a sufficient number survive to propagate the species, and that this is true of the bacillus of typhoid, which is the specific germ most to be feared in drinking-water in this country.

Thus far, however, our information as to the actual danger incurred in the use of the ice sold in this city has been very vague and indefinite; it could only be said that there was a possibility that such danger existed.

Under these circumstances Dr. Prudden has done a good piece of work in the shape of an investigation made in a well-equipped biological laboratory, on bacteria in ice, and especially on the bacteria contained in the ice-supply of New York City, and in presenting the results of his studies in a paper read before the New York Academy of Medicine on the evening of March 17.

Dr. Prudden is a competent bacteriologist; his methods of collecting and preparing specimens as he describes them are those of the best workers, and are satisfactory, and his report of the results observed we consider as accurate and reliable. The most important of these results relate to ice taken from the Hudson River, which is the principal source of supply for this city, the storage capacity of the ice-houses along the Hudson being over three million tons. The greater part of the ice harvested from this stream is taken between Poughkeepsie and Troy, and the water is contaminated by the sewage from Troy and Albany, as well as from some other sources. The mean result of nearly three hundred examinations of ice showed that the average number of living bacteria per cubic centimetre was 2,033. In specimens of ice taken from the Hudson a few miles below Albany, and which was being sold in New York, from twenty to fifty thousand living bacteria were found in a cubic centimetre. An average of 32 analyses of the Croton water during the last five months gave 243 living bacteria per cubic centimetre, the lowest being 57 and the highest 1,950. His analyses of ice taken from the river at points from six to fifty miles

below Albany do not indicate any marked tendency of the river to purify itself from bacteria. The great majority of these bacteria found in the Hudson River must be harmless, but there is not only a possibility, but a strong probability that a few of them are dangerous. Dr. Prudden did not, however, find any typhoid bacilli in the specimens which he examined, nor did he find any excess of typhoid fever among those people in New York City who habitually use ice in drinking-water over those who do not. Dr. Prudden does not lose sight of the important commercial interests connected with our ice-supply, and he does not advise any diminution in the use of ice, even for drinking purposes. He suggests the advisability of skilled inspection of ice-harvesting fields, the advisability of knowing from what part of the river our iceman obtains his supply, the employment of water-coolers in which the ice is not placed in the water itself, and the need which exists for a long series of skilled investigations on this subject. It is very possible that our future ice-supply may be made artificially from pure water, and it will not cost much more than that which we get now.

Meantime we commend Dr. Prudden's paper for careful study, and his methods of investigation and caution in drawing conclusions for imitation by our own and other sanitary authorities.

SYRACUSE, N. Y.—Howard Soule and W. H. H. Gere, civil engineers, having examined plans which had been suggested for supplying water to Syracuse from the Salmon River, presented a report to the City Council, in which they condemned the proposed dam for a storage reservoir as unsafe and the estimates of its cost as too low. The projector estimated that the dam across Salmon River, about 4,000 feet long, 71 feet high at the deepest place and of an average height of 50 feet, would cost $439,000. The engineers estimate that it would cost $1,201,000, and that what between damages to hydraulic rights, pipeage of the city, and various expenses, the entire construction of the new works to take the place of those of the Syracuse Water Company would cost at least $4,773,000. This is for works intended to supply 15,000,000 gallons daily.

OUR BRITISH CORRESPONDENCE.

German Egineers on Galvanized-Iron Pipe—Heating Railway-Cars by Hot-Water Apparatus—Telephonic Communication between London and Croydon—An Amendment to the Rivers Pollution Act.

LONDON, March 23, 1887.

I NOTICE it reported as the result of experiments instituted by the committee of the German Gas and Water-Works Engineers on galvanized-iron pipes for water-supply, that, although in the case of new pipe, the water took up zinc, it was found not to be injurious to health, and the meeting of the society accordingly passed a resolution that the use of such pipes is not prejudicial to health.

Although imitation is said to be the sincerest flattery, it, in very few instances, reflects credit on the imitator. This is very largely the case in connection with the Compagnie des Chemins de Fer de l'Est, Paris, who have decided after lengthened trial to adopt the system of heating their trains by the employment of stoves and hot-water apparatus fitted to each carriage. The circulation of the hot water is through the flooring. Fixed points are provided at which the stoves are stoked in the course of the journey. The estimated cost of heating is about 2*d.* (4 cents) per hour per car. Fortunately the ordinary pace of railway locomotion in France is very moderate indeed, so that there is at all events an extra chance that the disasters which have been from time to time reported from America may not be duplicated there.

There is now regular telephonic communication between Croydon and London, a distance of some ten miles. The telegraph posts of the London and Brighton Railway are utilized for carring the telephone wires.

A bill has been introduced in Parliament to amend the Rivers Pollution Prevention Act of 1876, by repealing the twelfth section of said act and substituting the following: "An inspector of proper qualifications, appointed for the purposes of this act by the Local Government Board, upon being satisfied that the person complained against has used, and is, in his opinion, using such reasonable and practicable means as are available under the circumstances of the particular case for rendering harmless any sewage matter, or poisonous, noxious, or polluting solid or liquid matter, falling or flowing, or carried into any stream, shall grant a certificate to that effect, which certificate shall in all courts and in all proceedings be conclusive evidence of the fact; such certificate shall continue in force for a period to be named therein, not exceeding two years, and at the expiration of that period may be renewed for the like or any less period."

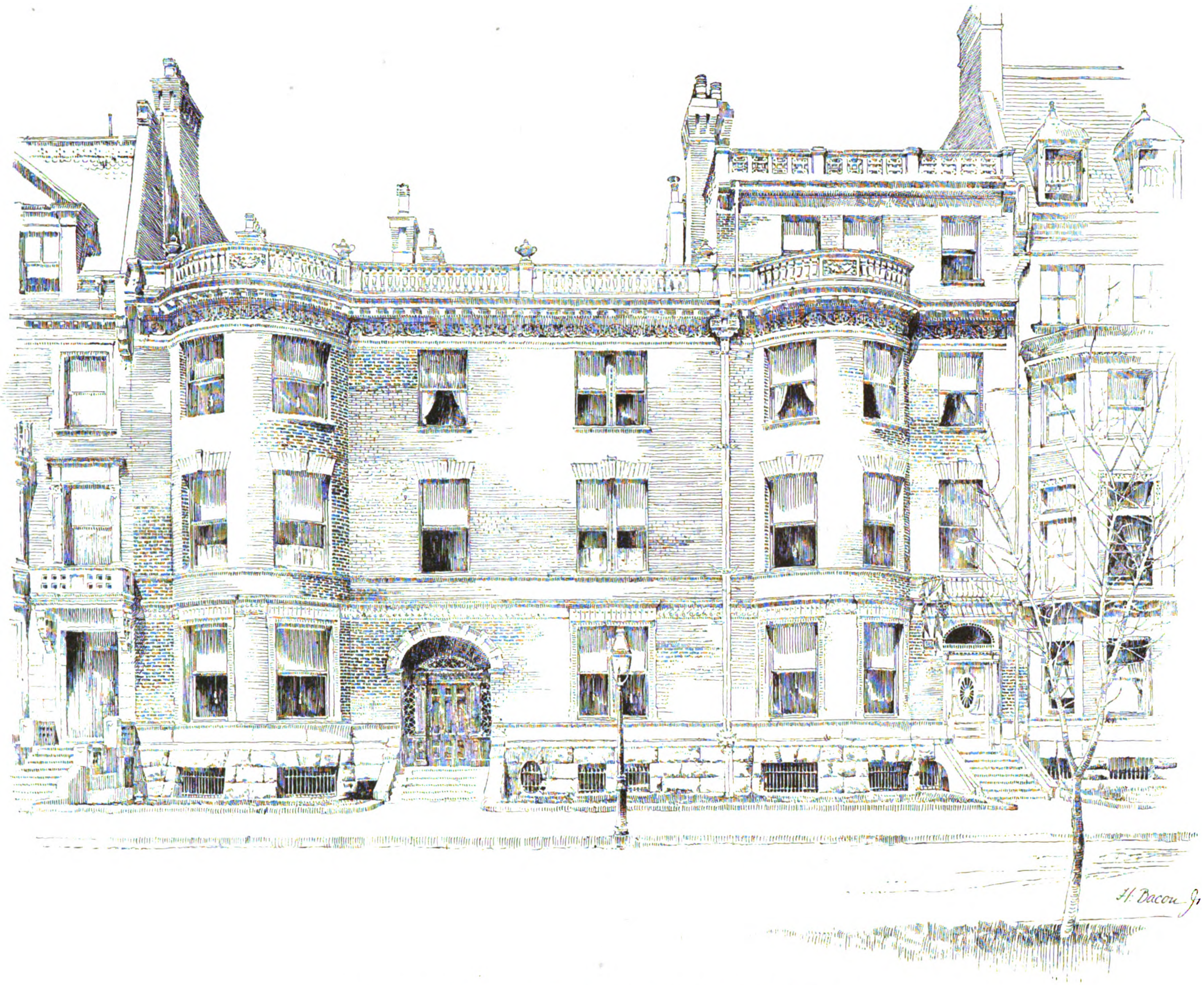
SAFETY-VALVE.

UNDERGROUND TELEGRAPHS IN FRANCE.

THE laying of underground wires was commenced in France in 1880, but its development has been stopped on account of the great expense. Paris, Lyons, Marseilles, Bordeaux, Havre, Lille, Nancy, and some military centres are, however, now connected with cable. The cables already laid represent a weight of nearly 13,000,000 kilogrammes, and over 383,000 kilogrammes of asphalt have been used in laying them. The cost has been 37,572,000 francs, and the system has given general satisfaction. The cables are laid about three or four feet below the surface. The system in France was adopted not so much to insure constant communication between commercial centres as on military grounds. The Minister of Posts, when applying to Parliament for 53,000,000 francs—the original amount asked—spoke of the work as one of national defense. There was the danger that a tempest might just interrupt the mobilization of the army. Overhead wires are also easier to cut than the subterranean, though the cutting of the latter is not at all impossible, for the Germans no doubt know where the wires are laid in France as well as the French themselves.—*Electrician.*

A BILL relating to the electric subways in this city has been agreed upon by the Subway Commission and the Construction Company and sent to Albany. It retains the present commissioners in office for two years, and adds to the commission the Mayor, Comptroller, and Commissioner of Public Works. The bill appears to diminish the control which the commission can exercise over the constructing company.

RESIDENCE OF W. T. TALLIAFERRO, GLENRIDGE, N. J.—W. C. HAZLETT, ARCHITECT.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCES OF MESSRS. WILLIAM POWELL MASON AND WINTHROP SARGENT, BOSTON, MASS.

ROTCH & TILDEN, ARCHITECTS.

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

RESIDENCES OF WILLIAM POWELL MASON AND WINTHROP SARGENT.—ROTCH & TILDEN, ARCHITECTS, BOSTON.

OUR special illustration this week shows the residences of Mr. William Powell Mason and Mr. Winthrop Sargent, Boston. The architects were Rotch & Tilden, of Boston.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE OF W. T. TALLIAFERRO, GLENRIDGE, N. J.—W. C. HAZLETT, ARCHITECT.

THE subject of our vignette illustration is the residence of Mr. W. T. Talliaferro, Glenridge, N. J. The building is frame, with stone foundation; first floor hard wood, the other floors white pine. The cost $5,000. The architect was W. C. Hazlett, of New York.

COTTAGE (SMALL) HOSPITAL CONSTRUCTION.

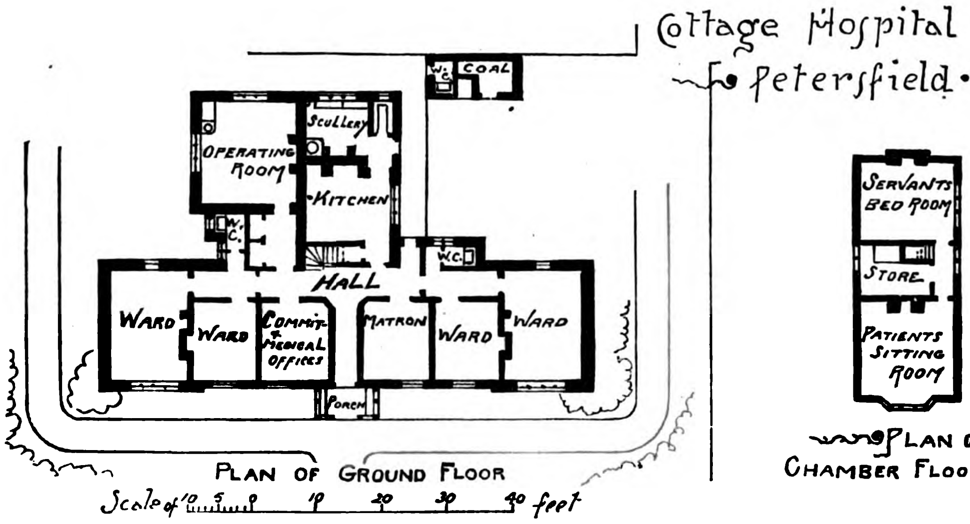
BY HENRY C. BURDETT.

Author of Cottage Hospitals, Pay Hospitals of the World, etc.

No. XIV.

THE COTTAGE HOSPITAL, PETERSFIELD.

THIS hospital, apart from the defective arrangement and location of its water-closets and lavatories, is worthy of attention owing to the simplicity of the arrangements, the picturesqueness of the elevation, and the cross-ventilation which has been been secured for the main wards. The plan, it will be seen, belongs to what is known as the straight system—a point which I shall have most to say about in a later article. The hospital was erected in 1870 from the plans of Mr. F. W. Hunt, architect, and many important operations and much good medical work have been done within its walls. Any one coming to Europe and being interested in small hospitals should take an opportunity of visiting Petersfield, not only to see this hospital, but to enjoy the beautiful country and neighborhood in which it is situated. The drive from London to Portsmouth through Guildford and Petersfield by coach constitutes one of the most enjoyable excursions in fine summer weather that can well be imagined.



THE SELECTION OF THE ARCHITECT OF THE BOSTON PUBLIC LIBRARY.

(From a Special Correspondent.)

THE report of general dissatisfaction among Boston architects at the selection of Messrs. McKim, Mead & White as the architects of the Boston Public Library, quoted by THE SANITARY ENGINEER AND CONSTRUCTION RECORD from the New York *Evening Post*, arose from a very unfair article in the Boston *Globe*, which contained only the opinions of those who were not pleased with the action of the trustees. An act of Legislature about a month ago placed the matter of the selection of an architect solely in the hands of the trustees.

Very few of the Boston architects, so far as your correspondent is aware, have criticised the action of the trustees on the ground that a Boston architect was not selected. Of course there is a natural difference of opinion in regard to the capabilities of the chosen architects for this class of work, but the general opinion is favorable to the action of the trustees and their selection is considered a wise one. It is also welcomed as a blow at the "competition system" and at narrow local prejudice. It is not unworthy of remark that this is one of very few, if not the sole instance where a large public building has been given to an architect without the *form* at least of competition.

This action is in marked and favorable contrast to that of the Court House Commissioners who last year instituted a competition which gave every assurance of fair play, but whose terms the commissioners disregarded in giving the construction of the building to the architect for whom they had a preference upon the results of a preliminary competition, a second and final competition among competitors chosen by the preliminary competition having been abandoned after being definitely promised. The trustees in this instance have pursued the wiser and more courageous course of selecting the architects in their opinion best fitted for this particular work after the consideration of the completed buildings of various architects in different localities, the choice being evidently made on account of the artistic merits of the work done by the firm selected.

REGARDING THE STUDY OF ARCHITECTURE.

WE present below further letters on this subject in continuation of those published on page 463, last issue.

Professor Charles Babcock, Professor of Architecture at Cornell University, writes:

"The knowledge of drawing acquired by a year's work in an architect's office is a great advantage to a person entering a technical school for the purpose of studying architecture. In the Cornell University it will hereafter be required of all who take the special two years' course. It is not necessary for those who enter the regular four years' course, unless they wish to take advanced standing, passing up the studies of the Freshman year.

"At Cornell any person at least twenty-one years of age, and having satisfactory attainments, may be admitted by vote of the Faculty, without examination, *as a Special Student*, on the recommendation of the professor in charge of any department in which he is to take a large part of his work. Such students cannot be candidates for a degree or a licentiate certificate; and their admission must be renewed every year.

"Special students in architecture must have served for at least one year as draughtsmen in an architect's office; and must be proficient in geometry, plane and solid, and in algebra so far as to be able to solve cubic equations. They will be admitted only at the beginning of the fall term, and must take a prescribed, not optional, course."

Professor T. M. Clark, of the Massachusetts Institute of Technology, writes:

"My experience is that the students in the Architectural Department at the Massachusetts Institute of Technology, who have had a year or so in an office, work, as a rule, rather more intelligently and with more enthusiasm than those who come direct from school."

Mr. Leopold Eidlitz, of New York, writes:

"A young man desiring to study architecture should receive his education first at some polytechnic school or university where he can acquire a thorough knowledge of mathematics and mechanics and practice architecture, drawing, and modeling, and then become familiar with architectural forms.

"This can be done best at Columbia College, the Technological Institute of Boston, and Cornell University, where architecture is one of the branches of education.

"Without the mathematical course a knowledge of architecture is impossible, and without an early practice in architectural drawing the student of mathematics becomes obtuse to art impressions.

"The ordinary course of architecture as provided in the above-named schools does not complete the education of the architect.

"A post-graduate course of two years, somewhat after the system of the Architectural Academy of Vienna, seems desirable.

"After that a short practice with some able architect of six months or a year is of use."

Mr. Edward H. Kendall, of New York, writes:

"The answer to your second question is not a difficult one, as there are, in this country, at least three well-known technical schools where the theory and practice of architecture are thoroughly taught. As to the other question, I do not see any adequate benefit to be obtained by first entering an architect's office, but, on the contrary, do see possible harm, as the young man could not then be so able to discriminate between good and bad practice as he would later, and might consequently fall into faulty methods which would with difficulty be unlearned, and, even granting that the practice of the office which he enters is of the very best, I think he would in three months or less, after the academic course, learn quite as much or more than a full year could have taught him before such preparatory course.

"Having thus answered your questions to my own satisfaction at least, allow me to say further that the time is now come when architects, especially those of us who have not had the advantages of the systematic and comprehensive study which the present day offers to the student of architecture, should refuse admittance to their offices, as students, any young man whose welfare they may have at heart, or who can at all afford the expense of a collegiate course. Such a step, coupled with the extending of a decided preference for, or, better still, with an arrangement for the exclusive employment of such students of accepted schools as have fulfilled the requirements of honorable graduation, would place the practice of our profession upon the safe middle ground of a collegiate diploma, which would probably accomplish more in the cause of good architects, of good architecture, and of the public good, than any method of licensing which is at all likely to be devised and enforced."

Mr. Maurice Fornachon, of New York writes:

"The best course for a young man to pursue in the study of architecture is a very difficult programme to lay out to fit every case. I would advise the young man to study for two or three years either at Columbia School of Mines—architectural course—or at Institute of Technology at Boston; then enter an office and work his way up. In his case I believe it would be a loss of time to enter an architect's office in the first place."

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XVI.

(Continued from page 428.)

In concluding our account of the work done at the Equitable Building, we present a description of the method pursued to shore up an important column in the interior, for the purpose of removing the wall beneath and continuing the column to the basement. This was necessary in rearranging the ground floor, which was two stories below. The full details of the floors and subsidiary shoring are not shown in the figure, but there was an abundance of support. The load coming on the column was in the neighborhood of 200 tons, and it was taken on eight screws symmetrically placed around the column. The details of the cast-iron jacket are fully shown. The two parts were brought to a firm bearing on the column by six 1¼-inch screw-bolts. Advantage was taken of the lugs above to assist in taking the strain, and iron struts were inserted between them and the flange of the column. An additional reason for making the changed arrangement was that the supporting wall was found to be cracked and in bad condition. The iron beams had a span of some fourteen feet, and the necessary rigidity was obtained by using the number shown.

A careful computation of weights in the new building showed that some of the old iron columns were of insufficient strength to be entirely safe under the new loads. These columns were made up of two channels, with flanges turned outward and iron plates riveted to them. They were strengthened by bolting to them on one side a cast-iron channel, twelve inches wide, with 5-inch flanges, and an average thickness of about two and one-half inches. Depressions were cast for the rivet-heads, and a slot cast at the upper end, just wide and deep enough to pass over the floor-beam attached at that point. The fit was snug, so as to require the strengthening column to be driven into place. Flanges were cast at top and bottom, so as to attach the lengths in consecutive stories by bolts, and the castings were also bolted at four points by through bolts to the columns in place.

An undertaking of the magnitude of the Equitable job, making such extensive changes, and at the same time continuing the use of a large portion of the building, involves a constant succession of difficult problems. We have described enough of these to give a clear idea of the work.

The introduction of pneumatic dispatch tubes, electric-light, telephone, and other wires, and all the latest improvements in plumbing, heating, etc., adds to the complexity of the operations. The speed with which the work is progressing, too, is wonderful even in these days when space and time seem almost to be annihilated. It is announced that the work will be completed by May 1, in which case the time of construction will have been but little more than a year. This result is chiefly due to the successful planning and watchful care of Mr. G. B. Post, the architect, and his able assistant, Mr. R. Maynicke, and the energetic management of Mr. D. H. King, Jr., on whom the general responsibility of the work of construction rested.

But all the contractors (the names of most of them having been mentioned in previous articles describing this work in The Sanitary Engineer and Construction Record) are deserving of credit for their share in it.

(To be continued.)

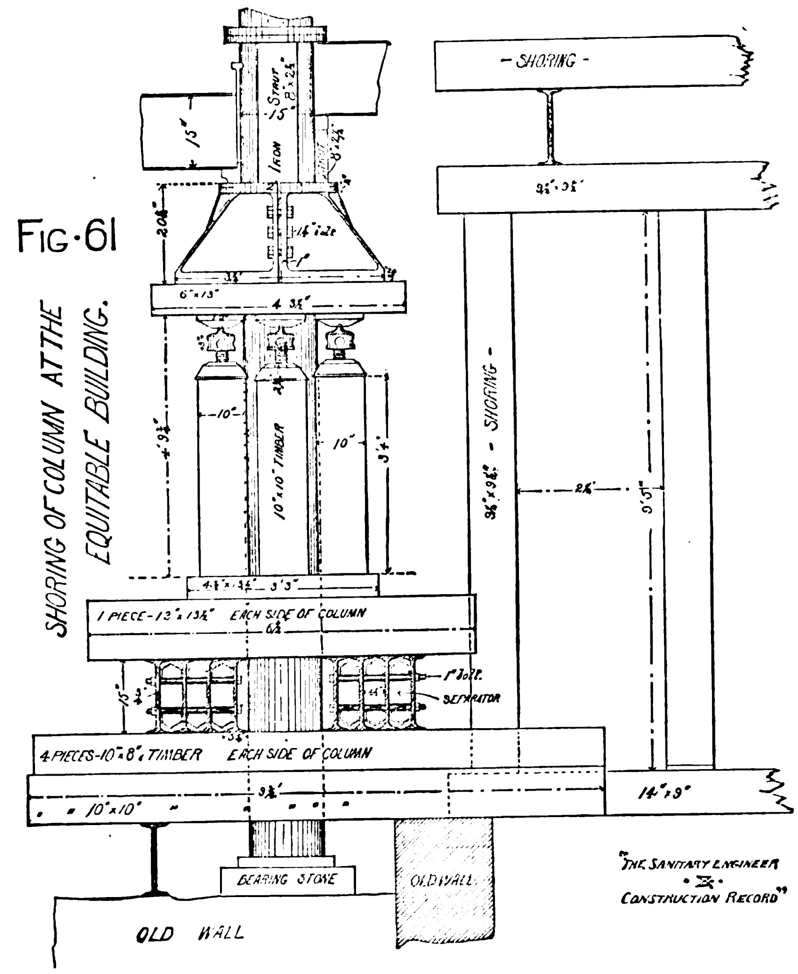


Fig. 61

THE REMOVAL OF SHALLOW FLOWAGE FROM THE BOSTON STORAGE-RESERVOIRS.

BY DESMOND FITZ GERALD, M. AM. SOC. C. E., RESIDENT ENGINEER.

No. I.

The phenomenal growth of the country and the rapid development of water-supply systems has led engineers, as a rule, to pay more attention to quantity than to quality of supply. With increasing resources and greater experience more and more study will be given to the delivery of *pure* water.

The city of Boston has been supplied with water from a public system rather longer than the majority of the cities in the United States, and she has had several disagreeable experiences with bad water which may prove useful in pointing out possible sources of contamination.

Between 1846 and 1872 Boston depended upon a single source of supply, Lake Cochituate. From this lake an aqueduct, six feet four inches high by five feet wide, conveys the water some fifteen miles to the distributing-reservoirs.

On more than one occasion the water has developed a fishy or cucumber taste which has seriously annoyed the water-takers. The probable cause of this taste we shall refer to later.

Although the water-shed of Cochituate Lake had proved insufficient for the wants of the city for a number of years, it was not until early in 1875 that final action was taken toward the building of what is known as the Sudbury River system. A temporary connection, however, to supply Lake Cochituate from the river was made in 1872. The drainage area of the Cochituate water-shed is eighteen square miles, of the Sudbury River water-shed above the point of taking seventy-four square miles.

The Sudbury works consisted briefly of a system of large storage-basins in the river valleys and a short piece of aqueduct leading from the lowest dam to one end of Farm Pond, a natural sheet of water of about 165 acres area. From the other extremity of this pond a brick aqueduct, nine feet wide and sixteen miles long, leads to Chestnut Hill Reservoir, in the suburbs of the city. Although the original plan contemplated the building of several storage-basins on the river, three only were built at first, and they were completed in 1879. It was the intention of the engineer, Mr. Joseph P. Davis, to have had the basins built a long time before this date, but owing to the failure of appropriations and the inability to understand the critical condition of the city in regard to its water-supply the building of the basins was delayed so long that it became necessary to use the stored water they contained as soon as they were completed. Had they been built earlier they might have been washed out for months before going into actual use. It seems doubtful, however, in the light of subsequent experience, whether several years is sufficient to make a good storage-basin out of a large, freshly-flooded district on which no other work has been done than to cut down the trees.

Water was first run through the new Sudbury River aqueduct on February 13, 1878. Basin I., covering 149 acres, the lowest on the river, was first filled in January, 1879; Basin II., 136 acres, in December, 1876; and Basin III., 283 acres, in August, 1879. Practically no work was done on the bottom or sides of these basins except to cut down the trees. The stumps were left standing, and all around the margins were acres of shallow flowage. In October, 1881, a very bad cucumber taste developed in Farm Pond, the link in the system connecting with the aqueduct in the way already explained. As all the Sudbury water had to be passed through Farm Pond it all became tainted, and widespread excitement was caused in the city. The water was so offensive that taking a bath often caused nausea. The Committee on Water of the City Council engaged Prof. Ira Remsen, of the Johns Hopkins Institute, to make an examination into the cause of the trouble. After very careful analyses, Professor Remsen, in a report (City Doc. 143, 1881) to the City Government, ascribed the bad taste in the water to the presence of an abnormal quantity of *spongilla fluviatilis*, or fresh-water sponge, in the waters of Farm Pond. Active steps had already been taken to build a canal around the pond, but by the time the canal was finished the bad taste had passed away from the water.

The following year the physicians took up the question of improving the quality of the water. Their theory generally was that the shallow flowage and the wash of the loam from the banks into the water in the effort of the basins to form natural shores was the chief cause of the growth of the sponge in Farm Pond. A special commission, consisting of several well-known citizens, was appointed in September, 1882, to take the whole matter into consideration, and in February, 1883, their report was made to the City Government with four recommendations, as follows:

First—That an aqueduct shall be built across Farm Pond.

Second—That the aqueducts shall all be periodically cleaned.

Third—That the storage-basins should be deepened around the edges, no shallow flowage of less than eight feet tolerated, and all loam should be removed from this part of the bottom.

Fourth—Measures should be taken at once to reduce the consumption.

It was not contended by the commission that any proposed preparation of the basins would insure absolutely good water; in fact, it was expressly stated by them that no amount of work would protect a body of stagnant water, exposed to the summer sun, from deterioration, but they arrived at the conclusion, from the evidence of experts who testified before them, that the chances of further trouble would be greatly lessened by proper treatment. They say: "Given a large body of quiet water, the best way to

promote the growth of algæ and similar aquatic plants is to store the water in a pond so shallow as to allow it to become thoroughly heated to the bottom, and have that bottom composed of a thick layer of vegetable mold. Although the basins on the Sudbury River are sufficiently deep in the centres to keep the water tolerably cool, yet in each of them there is a large quantity of shallow flowage, where the conditions referred to exactly obtain. It is true that the experience of Boston is only that of many other cities which have suffered in the same way. It is true, also, that it is only from experience that wisdom is learned, and that it is much easier to say what should have been than to say what ought to be; for, if prophecies were made of future trouble when the basins were built, they did not carry conviction with them. The fact is now unquestionable, in the judgment of the commission, that the only way to properly construct a basin is to take the loam *all out*. Circumstances might be such that other means would have to be devised to accomplish the same result at a less cost, but no basin could be considered properly prepared for use in the near future which did not remove or entirely cover up all decaying loam. If a basin is not wanted for a number of years the loam might then be allowed to remain. A pond so constructed will annually work and ferment until all vegetable matter has been absorbed and carried off, and in course of time it will assume the condition of a natural basin; but the length of time that this will require is so uncertain that no city can afford to wait for its accomplishment by natural means. On the Sudbury River the basin from which this sort of trouble chiefly comes has greatly improved since first put in use. Its fermentation comes every year at a later date, and before many years the body of the basin will probably be in good condition; but the shallow portions must either be materially deepened or abandoned altogether, if any permanent and thorough improvement is to be anticipated."

The fact that the *spongilla* was responsible for the bad taste in the Boston water was doubted by several people whose judgment is entitled to some weight. The writer is firm in the belief that Prof. Remsen's conclusions were correct, and that all the evidence that has accumulated since 1881 has been in a direction to justify the accuracy of this belief. The writer has found that the *spongilla* grew in the greatest profusion in the Cochituate aqueduct, but had always been mistaken for a kind of mossy vegetation whose growth was thought to be harmless. As this aqueduct could not be properly cleaned when it was the sole source of supply, the sponge must have flourished and decayed *ad libitum*. Again, the writer has found an abundance of sponge growing in the main pipes of the distribution system in the city proper, where it was growing under a head or pressure of about 100 feet, which would fully account for the fact often noticed of bad water in one street and good water in an adjoining street. The sponge never got a foothold in the Sudbury aqueduct on account of semi-annual cleanings, until a large amount of gravel was dumped into Farm Pond, when it suddenly appeared in considerable quantities, growing on the bottom of the aqueduct for more than a mile from the influent chamber. The writer believes that the sponge will always be found to be an effective enemy to good water wherever it is allowed to grow and decay in large quantities, and that it is often the cause of a bad taste in water-supplies when its presence has not been suspected.

A second article will describe with illustrations the work performed in the way of removing the shallow flowage from the Boston storage-reservoirs.

(To be continued.)

PAVEMENTS AND STREET RAILROADS.

No. VI.

(Continued from page 375.)

Since the publication of our description of the Liverpool pavements (page 589, Vol. XIV.) we have received additional information from Mr. Dunscombe with some corrections, which we now publish:

Our description of first-class specification should read: "3¼"x3¼" blocks 6¼" deep on a 6-inch cement concrete foundation."

The second class should read: "Four-inch cubes, or 3"x5" to 7" and 6¼" deep, or 3"x5" to 7" and 5" deep." Where wood is used the blocks are 4"x5" to 7" and 6" deep. Where cubes are used starting blocks are set at the beginning of each course across the street, so as to insure a perfect breaking of the joints in passing from row to row. The term gravel, as used in the specifications, is *not*, as we would understand it, gravel containing no sand, but gravel and sand as they would come from the pit. Its fineness would depend upon the size of mesh through which it had been riddled, so that "fine gravel" would mean that which had passed through a half-inch mesh or less.

"In Liverpool we are very particular as regards the quality of the materials forming concrete—viz.: Broken stone, gravel and sand, all of which are perfectly clean, free from all foreign matter, and the best of their respective kinds that can be obtained. We have exceptional facilities for getting a supply of these materials from the River Dee, the Wyre, and the Isle of Man mines, which supply a gravel, granitic or otherwise, and sand of a superior quality, and in addition much good material is brought as ship's ballast."

We would call the particular attention of our readers to what Mr. Dunscombe says below on the subject of reinstating pavement over trenches and opening up of pavements:

"In cases where trenches are required for gas and water purposes, notice is given by the company to me; the trench is then opened by the company's workmen, and upon completion of the work the trench is filled in by them and the paving is also temporarily blocked in at the company's risk. The pavement is then reinstated in a permanent manner by corporation workmen, and the cost of the same and charges incidental thereto charged to the company. The Corporation execute this work as contractors only, and the company are liable for, and are actually charged, the cost of any repairs necessary during a period of six months in order to maintain the surface in a perfect condition.

"By written permission of the Corporation only, openings in the pavements are allowed to be made for the purpose of examination of private drains, and no other interference with the pavements is allowed, either in the carriageways or footways, except under Parliamentary powers obtained for the execution of the work, in which case ample protective clauses in the Act of Parliament are obtained by the Corporation, dealing with the conditions upon which any undertaking shall be allowed to in any way interfere with the streets or pavements. These clauses are comprehensive and fully protect all interests of the Corporation against any undue interference with the streets, and provide for their reinstatement, in a proper manner, at the sole cost of the promoters, in cases where such interference is permitted.

"Interference with the pavements in Liverpool is of rare occurrence, inasmuch as both the gas company and the Water Committee of the Liverpool Corporation thoroughly examine and reinstate where requisite their mains and services concurrently with the repaving of a street, of the execution of which due notice is given to them by my department. In no case would streets be allowed to be opened up so as to prevent the free passage of traffic along it, except in cases of the most extreme urgency, and even in these cases the local police authorities would regulate it, and the promoters of any undertaking would not be allowed to interfere at all with the streets and roads except under the most stringent regulations. The street traffic is a matter which receives the first attention at the hands of the municipality, as any interruption of it would be attended with serious inconvenience and loss."

On the subject of pavement in cities of the Continent of Europe and Great Britain he writes:

"In the area referred to there are innumerable descriptions of pavements, some good and some bad, and in many of the large cities and towns the same remark applies. Some of these cities and towns are, as a whole, extremely well paved, but in no city or town is the pavement laid down, so thoroughly well constructed, so durable, and so sanitary as in Liverpool; and what, to some, may appear extravagant in the methods here pursued can be proved by demonstration to be the most economical over a series of years. The cost of the maintenance of the carriageway pavements and footways in Liverpool is nominal, and a large proportion of the amount expended under this head is due to the retention of macadam roads, which are maintained as such owing to the exigencies due to local circumstances. The low cost of maintenance is obtained by laying down the pavements in the best possible manner, and making all repairs at once when needed, so that the pavements are always in a superior condition, and the cost of maintenance is reduced thereby to a minimum."

Mr. Dunscombe sends the following table as to the cost in Liverpool of pavements of compressed natural asphalt:

Thickness of Asphalt.	Price for construction and maintenance of carriageway for three years per superficial yard per annum.	Price for maintenance of carriageway from year to year by contractor, per superficial yard per annum.	Price for maintenance of carriageway by contractor for a further period of thirteen years, per superficial yard.	Price for repairs by contractor for carriageway, per superficial yard repaired.
1	2	3	4	5
⅞ inch.	... .	....	....	....
1 inch.	5s. 6d.	3d.	3s. 3d.	9s.
1¼ inch.	7s.	4d.	4s. 4d.	11s. 3d.
1½ inch.	8s. 6d.	4d.	4s. 4d.	13s. 6d.
1¾ inch.	10s. 3d.	9d.	9s. 9d.	16s.
2 inch.	11s. 3d.	6d.	6s. 6d.	18s.
2¼ inch.	12s. 3d.	6d.	6s. 6d.	20s.

The reason for the high prices in the fifth column is the small amount of repairs required and the loss of time consequent on this.

By the terms of the contracts with those putting down pavements, all repairs are to be made on twenty-four hours' notice from the City Engineer, and such repairs do not pay the contractor, often, for the work done. Column 4 of the table is obtained by multiplying the quantities in the previous column by thirteen.

(To be continued.)

POUGHKEEPSIE WATER-WORKS REPORT.

The water-works of Poughkeepsie, N. Y., have a certain interest as the first American works in which the system of sand-filtration as practiced in England was adopted. It has been kept up for eighteen years, and only one town has followed the example of the pioneer. The Water Commissioner's report for 1886 states that after uninterrupted use since 1872, the filters became clogged early in the year in consequence of an unprecedentedly muddy condition of the river, and it was necessary to remove all the filtering materials and cleanse it. Mr. Charles E. Fowler, the superintendent, states that the interstices of the sand had become so filled with silt as to make it "like compact loam, and about as impervious to water." The cleaning, washing, and replacing of 2,000 cubic yards of sand occupied five men about six months and cost $2,753. The depth of sand replaced on the lower gravel of the filter-beds was 23½ inches. Mr. Fowler's description of the method adopted is interesting. He says:

"In cleaning the beds hitherto an average of twenty men were employed who entered upon the sand with shovels and wheelbarrows and removed about a half inch of the upper surface. The barrows, and the tramping of the men, compacted the sand so that it was necessary to loosen it with forks after cleaning. In order to prevent this compacting of the sand, both in replacing and in subsequent cleaning, two bridges were constructed, one spanning each bed, resting upon cast-iron trucks, so as to travel lengthwise of the beds upon the coping of the side walls.

"From each bridge was suspended a platform capable of being raised or lowered.

"In replacing the sand twelve to fifteen men with barrows wheeled the sand upon the bridges and dumped it upon the platform below. Three men upon the platform spread the sand upon the bed, regulated the surface grade and moved the bridge from time to time as became necessary. Thus the entire body of sand was replaced evenly, with no tramping or pressure save its own weight.

"In cleaning the beds two men standing upon the platform remove the upper surface of the sand throwing it upon the platform, moving the bridge forward as the work progressed. All compacting of the beds by men or barrows is thus avoided.

"To render this system complete it will be desirable to lay a set of rails upon the coping for the trucks of the bridges to run upon and to arrange to facilitate the removal of the ice in winter. It is expected that two men will then be able to clean the beds and keep them in good order, and wash the sand throughout the year.

"The beds are now in as good working condition as when first constructed. They are able to filter the full capacity of the pumping-engine with a difference of level between the surface of water on the beds and that in the intermediate clear-water basin of less than one foot, and when first cleaned one bed is able to furnish the full supply."

The works supply to 1,699 services a daily average of 1,738,284 gallons, or 1,020 gallons per tap. There are 433 services which take their supply through meters and consume an average of 413 gallons each daily. As these are taps which are presumably the largest consumers of water, meters being put on because they were supposed to use more than the ordinary amount, the enormous and absolutely iniquitous waste of the general consumer can be readily seen. If, as seems not improbable from the figures given, there are over 1,200 services which waste daily 500

gallons apiece more than they need, there is an expenditure for coal alone of over $2,000 yearly in pumping water which is wasted. The Commissioners seem alive to the absurdity of this state of affairs and are requiring the use of meters more generally. There were added seventy-six meters last year, or twenty-eight more than the number of services added. This is fair for a beginning, but to be of much value the proportion of metres added yearly ought to be very much larger. The value of the report would be enhanced if the Superintendent would append to it a tabular summary of the statistics of the works in the form recommended by the water-works associations.

RECENT WATER-WORKS CONSTRUCTION.

XI.*

PUTNAM, CONN.

This town, lying along the banks of a stream which retains its Indian name of Quinnebaug, has a population of about 6,500, and has some importance as a manufacturing centre. It is at a junction of the Norwich & Worcester and New York & New England Railroads, and contains cotton, woolen, shoe, and silk industries.

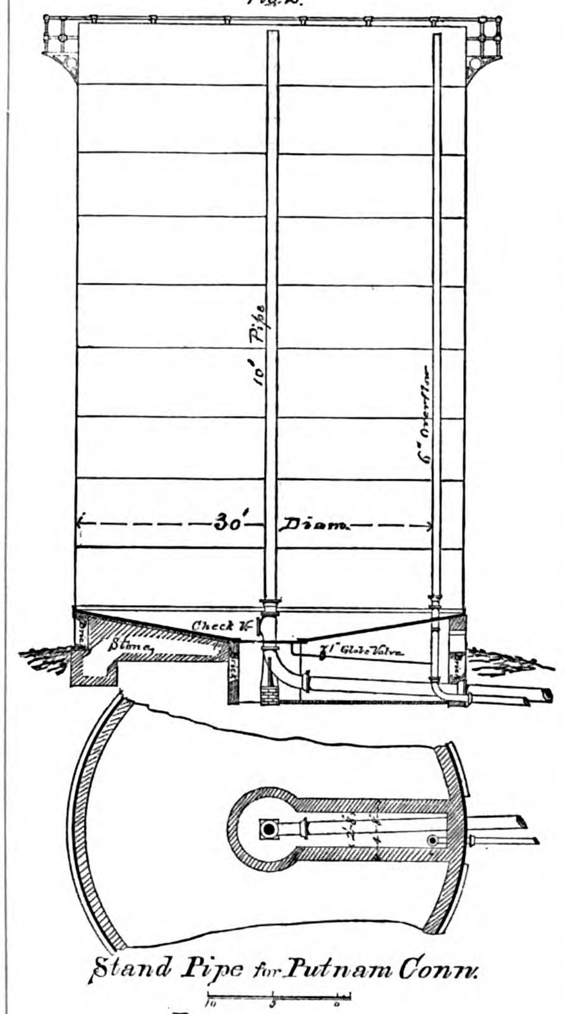
During the season of 1885 the town was supplied with water by the Putnam Water Co. The works were designed and built by Messrs. Wheeler & Parks, civil engineers, of Boston, Mass., and are now managed by the company, of which L. H. Fuller is President, E. Wheeler is Treasurer, and C. D. Sharpe is Superintendent. At the Cobossee Contee, a branch of the Kennebec, at Gardiner, Maine, to Little River, a branch of the Quinnebaug, furnishes Putnam with both power and supply, abundant in quantity and excellent in quality. The water-power is utilized by an 18-inch Hercules wheel working under a head of 22 feet and operating a 12x10½ Worthington duplex-power pump with a capacity of 1,000,000 gallons in 24 hours. The architect of the brick pump-house was Mr. J. H. Chapman, of Boston. The building is a model of simplicity, and the general arrangement of the pumping plant is shown on the ground plan in Fig. 1, also on a larger scale a conical detail.

The pump forces the water through some 2½ miles of 10-inch cast-iron pipe to a wrought-iron stand pipe (Fig. 2) whose top stands 170 feet above the crest of the dam at the pumping-station.

There are about 12 miles of mains, 220 taps, a dozen meters, and enameled iron is used for service-pipe.

In the erection of the stand-pipe a firm and even bearing was secured by putting the bottom and one course of sheets into their final position, thus leaving a space of two inches between the conical bottom and the masonry foundation, and filling this space by pouring in a grout of equal parts of Portland cement and sand by means of troughs and two

Fig. 2.

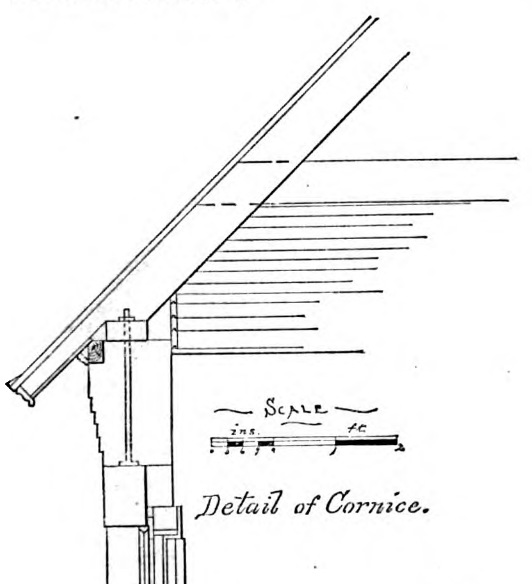


Stand Pipe for Putnam Conn.

gangs; the bottom portion of the stand-pipe being meanwhile supported in position by blocking.

The builders of the stand-pipe were Messrs. E. Hodge & Co., of East Boston, Mass.

* No. X, the Water-Works of Gardiner, Me., was published in our issue of December 18, page 65.



Detail of Cornice.

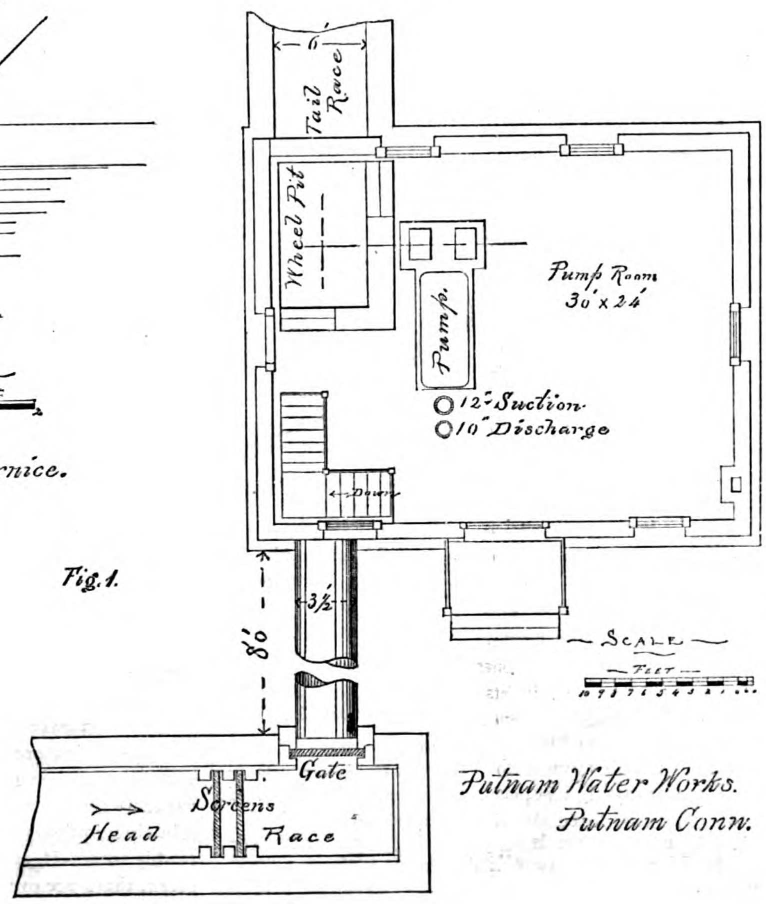


Fig. 1.

Putnam Water Works. Putnam Conn.

RECENT SEWER CONSTRUCTION.

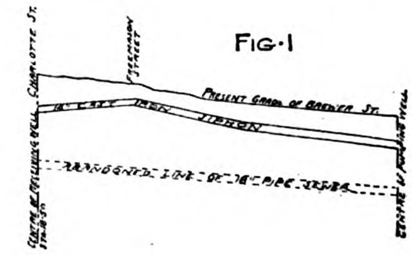
No. IV.

SYPHON OUTLET FOR A LOW SEWER DISTRICT, NORFOLK, VIRGINIA.*

Early in the year 1882, the sewerage of the city of Norfolk, Va., was begun according to plans prepared by the author and under his direction. One of the sections to be drained was, according to the original design, to be connected with the pumping-well by a long line of 18-inch pipe sewer through Brewer Street, laid, at its deepest part, 19 feet below the surface, and for a long distance to a depth of more than 16 feet.

The contractor succeded in laying this sewer as far as Charlotte Street, 1,850 feet from the pumping-well. The work had for a great length been extremely difficult and hazardous, on account of a troublesome quicksand encountered after descending nearly to tide-level, at this point about 10 feet below the surface. Thus far the street had been bordered only by houses of moderate size and weight. Below Charlotte Street there were several large buildings, including one very large brick Masonic Temple,

Fig. 1



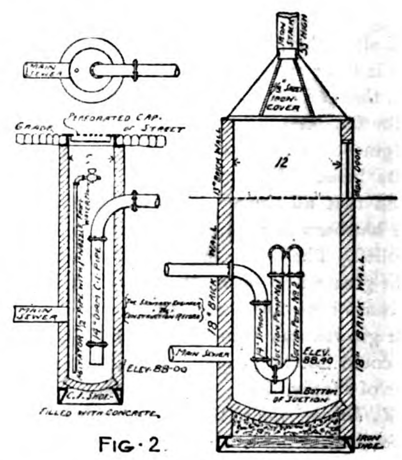


Fig. 2.

which would obviously be endangered by the running of the ground were the attempt made to carry the sewer past it at full depth. There was no other course through which this outlet sewer might be taken without equally serious difficulties; it became necessary, therefore, to devise special means for passing these large buildings without deep excavation.

On the resumption of work in March, 1884, the author submitted a plan for passing by this obstruction with a syphon, which was carried into execution. The work was completed in May, 1885, and a satisfactory and effective outlet was thus afforded for this important drainage district.

The details of construction are shown in Fig. 1 and Fig. 2. Figure 1 is a profile of the line from the centre of Charlotte Street, along Brewer Street, to the pumping-well. The lower lines are the grade lines of the 18-inch pipe sewer provided for in the original plan. The surface line is the surface of Brewer Street at its present, completed, grade. The upper lines show the horizontal course of a 14-inch cast-iron pipe constituting the outlet syphon. At Charlotte Street it is 7 feet 8 inches below the surface. At Freemason Street, the apex of the syphon is 1 foot 6 inches higher than at its starting point. It is 4 feet 2 inches below the surface, and at the lower end of Brewer Street it is 6 feet 8 inches below the surface. At this depth there was no obstacle to easy and rapid work. The fall of the syphon from the apex to the lower end of Brewer Street is about 9 feet.

Figure 2 show sections and relative elevations of the receiving-well, at Charlotte Street, and of the pumping-well at the lower end of Brewer Street; also the arrangement and relative elevation of the intake and discharge of the syphon, and of the suction-pipes of the sewage pumps.

* A paper by George E. Waring, Jr., M. Inst., C. E. From Proceedings of Institution of Civil Engineers.

The lower end of the syphon, in the pumping-well, is furnished with a return bend of which the outlet, opening upwards, is 5 inches higher than the intake at the upper end of the syphon. Therefore, as no flow can take place *below the* mouth of the outlet, the intake must at all times be submerged at least 5 inches and both ends of the syphon *be permanently* sealed. At the apex of the syphon, there is an elevated chamber, with a shut-off gate and check-valve, connected by a 2-inch galvanized pipe to an air-pump at the pumping-station.

The syphon was charged by allowing both wells to fill to a sufficient height, and by working the air-pump until it drew water. From that time until the present, the syphon has acted constantly, and without difficulty or obstruction of any sort. This pump is worked for a few minutes every day.

In a letter to the author, dated the 28th of August, 1886, Mr. W. T. Brooke, the City Engineer of Norfolk, writes: "The working of the syphon has been all that could be expected. It would be sufficient to say that it has never ceased to work since it was charged at the beginning, but it has stood even a more severe test than this. Last winter a water-main burst in Brewer Street about 100 feet beyond the upper well. There was a broken 18-inch pipe just under the point where the main gave way, and in consequence before the leak, which occurred at night, could be stopped, at least thirty or more cartloads of sand were washed into the upper 5-foot discharging well. It all passed over into the lower well, and neither then nor at any other time since the syphon was started, have I had to remove a shovelful of anything from the upper well."

The paper is accompanied by several diagrams from which the figures in the text have been engraved.

THE WISCONSIN RIVER IMPROVEMENT.

A REPORT on this river transmitted to the Secretary of War by the Chief of Engineers on December 30, 1886, gives an important report made by Captain W. L. Marshall, and concurred in by the Board of U. S. Engineers for River and Harbor Improvements. The plan of improvement adopted by General Warren in 1871, and persisted in up to 1882, was to build low brush dykes and wing-dams in the bed of the stream, so as to concentrate the current in a narrower channel. The bed of the river being sand, yielded readily to this increased force, but the improvement was not so great as was anticipated, and the work since that date has been confined to keeping the dams in order and carefully observing the changes caused by previous work.

These observations show that the effect of an increase in the number of contractions and expansions by dams has been to increase correspondingly the *number* of bars and pools, to diminish the *depths* of the pools, and (if the dams are sufficiently numerous) either to increase the depth *on the bars*, or to lower the water-surface, or both. The improvement in the channel is apparent only, as it is narrow and tortuous and shifting, and its regimen is unstable, owing to the shifting of the sands. It is still a succession of pools and bars, ponds and rapids. The slope is from 19 to 22 inches per mile.

The result is that any equalizing of the slopes causes at once a considerable lowering of the surface and average depth, and the rapid current and winding channel makes navigation difficult. The opinion is confidently expressed and is borne out by the observations that this method of improvement must be a failure in a stream of this character.

The gradual lowering of the water plane has ceased since the year 1882, when work was stopped, and now aggregates nine-tenths of a foot. The mean depth is one and eight-tenths feet more than in 1867, but nine-tenths of a foot less than in 1882. The slope now varies from 0.32 to 2.82 feet at different points, and there were 91 days in 1886 when there was a less navigable depth than four feet. The cost per year for repairs is $585 per mile, and would be for the whole river $70,000, aside from renewals.

The board conclude that if a 4-foot navigation is required, a return to the original scheme of General Warren of a canal costing $4,000,000 is altogether the best plan. The practical importance of the improvement is, however, greatly lessened by the parallel railroad lines now in existence, and the sharp competition in rates.

The methods by which these conclusions have been reached are detailed in Captain Marshall's report.

HEALTH COMMISSIONER OTTERSON, of Brooklyn, will appoint a board consisting of master and journeymen plumbers and representatives of the Board of Health to examine all plumbers who apply for registration.

HOT-WATER HEATING AND FITTING.*

BY "THERMUS."

No. II.

(Continued from page 459.)

IN considering the motion of water in the cube in our last issue we saw how the loss of heat from the surface of the cube destroyed the equilibrium of the particles of the water, and they descended. We also saw that an application of heat to the middle of the bottom produced a like result, by warming the particles near the centre, which gave them an upward movement; the particles at the side taking their place by gravitation.

If we now take a long cylinder or pipe filled with water, as shown in Fig. 2, in which the water is warmer than the air about it, the circulation will be found to go on just the same as in the cube when it was first laid on the table, and from the same cause—*i. e.*, the gravitation of the heavier particles between the lighter ones.

If we now take a long pipe and bend it into the simplest form of a closed circulating apparatus—say as shown in Fig. 3—we will still have local reversed and down currents in our *up* or flow pipe close to the sides, as seen in the

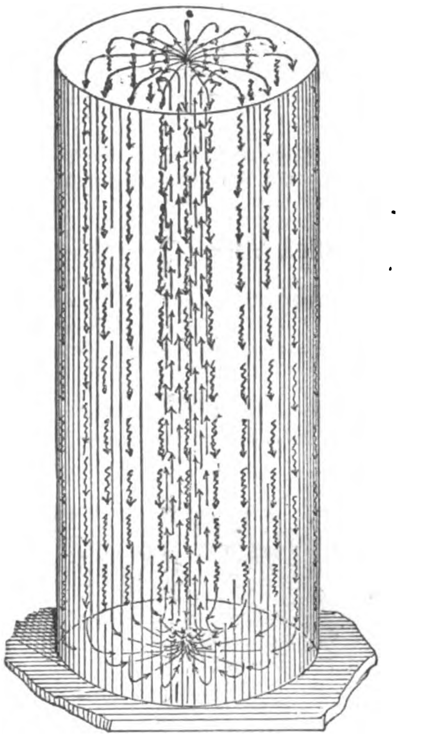


FIG. 2.

main flow-pipe at *a*. This is a factor to retard circulation not generally considered and still of too much importance to be entirely overlooked.

In a cube or short cylinder, or in a kettle on the fire, this circulation is shown at its best; and there is then no other, and it is the main or primary circulation, such as goes on within a boiler. In a cube or short tube cooling on the table, as shown before, it cannot very well be called a primary circulation, as it is not caused by an increase of heat, but by a loss of heat, and therefore might very well be called a secondary circulation when contrasting it with a circulation caused by the addition of heat alone; but in considering the result and not the cause, and as the two causes are nearly always present in a warming apparatus, we must know this local circulation by the name of primary.

It is found in the boiler on the outer sides in the diagram at *b*, by the direction of the arrows.

If fire is now made in the boiler a general circulation is set up, which passes up the middle of the pipe *a* and over into the pipe *c*, to return to the boiler again. Some of this water, however, which starts from the boiler, and which ordinarily is supposed to shoot right through the pipe *a*, tries to return by the same pipe. Presumably, unless the pipe is very large in diameter any considerable quantity of it never again gets into the boiler through the pipe it leaves by, but then nevertheless it sets up this rolling motion at the surface of all ascending water-pipes, and forms a factor against the velocity and ease of flow, very similar to the resistance of friction, and which naturally increases the friction factor, as it establishes water-currents in opposite directions, giving a rolling motion to the particles and causing eddies against the wet side of the pipe.

* NOTE.—These articles will be a continuation of the series on "Steam-Fitting and Steam-Heating" by the same author.

This motion, at the surface of the pipe or cylinder, is sometimes called "molecular" circulation, which very well expresses the condition, but "local" circulation is the most comprehensive term for it.

If the reader wishes to observe for himself the "local" circulation which goes on within hot-water pipes, let him take a small tin can for a boiler and make a simple circula-

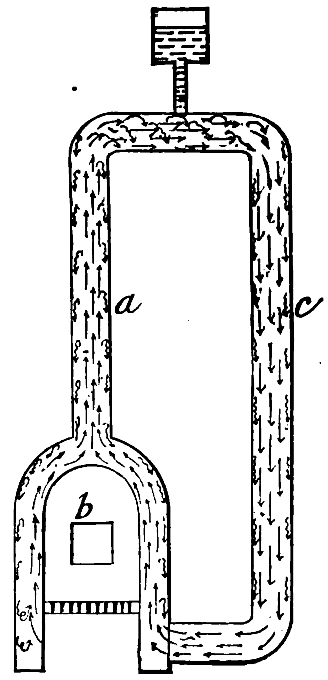


FIG. 3.

tion of glass tube from its top, returning to the side again. He may then fill it with water and put in some very fine charcoal, when, upon applying heat to its bottom, the action of the water can be observed with advantage.

This local circulation always affects the general forward movement of the main current in an apparatus. We are unable, however, to determine the extra resistance to the flow in the upward pipes from this cause, but it is considerable, and is in a direct ratio to the outward surface of the pipe compared to its volume, being small when compared with the large diameter pipes and causing no very practical drawback to their circulation, but comparatively great in the case of small pipes, so that a point can be reached by reducing diameter and increasing length where a local circulation would go on for a certain distance up the pipes, but the main circulation through the circuit would not take place the pipes being warm to the touch for some distance of their length upward, and cold beyond, giving the general impression that the heat of the boiler has been conducted to that height by the iron of the pipe or by the passage of heat from contact of particles not in motion; and while this may be so to a certain extent, it is more largely caused by local circulation in the lower end of the small pipe.

Local circulation goes on even in horizontal pipes, but in such cases it cannot be said to affect the flow—certainly not to an appreciable extent.

The course of local circulation in a horizontal pipe would be from the top to the bottom side, with an upward or return current at the centre when the pipe is giving off heat. At the same time the forward motion would be going on by the force of the main circulation, giving particles of charcoal held in suspension the appearance of a screwing motion along each side of the pipe, the particles on one side of the pipe when you look down upon it circling in one direction and others in a contrary direction.

In the downward pipe there may be said to be no local circulation. None is apparent, though some particles will be found to fall more rapidly than others; as in such case the main current and the local currents, if any, are in the same general direction. It is easy to understand how the water directly in contact with the surface of the pipe might fall a little faster than in the middle of such a pipe, it being a little colder, but this is not always observed to be so, as, in cases where the pipe observed is part of a main circuit, the water will be hurried along by the main current in the centre of the pipe faster than it will move against the sides, on account of friction, etc. In the down pipes, however, both currents tend in the same direction, and the tendency of the surface current is to lessen friction or resistance to the main flow and need not be considered.

We will, therefore, for convenience, in these articles, call all currents not working or moving in the direction of the the main current, local currents, and the currents induced within the boiler by the heat a primary current, while the circulation through the main flow-pipes and back again through the main return-pipes will be known as the main current, or the main circuit; the circulations through all branches, coils, or radiators being known as branch circuits or branch currents.

(TO BE CONTINUED).

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. XII.

(Continued from page 460.)

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

HOUSEMAID'S SINKS.

19. What is the neatest kind?

An earthenware one.

20. Is a lead-lined sink objectionable?

Yes; it is difficult to keep clean, and is easily injured or worn.

21. Is a fixed strainer advisable?

Yes; it is indispensable.

WASH-BASINS.

22. What is the usual size of a wash-basin.

Fourteen inches. All plumbing fixtures are measured on outside.

23. What size should the hot, cold, and waste pipes be?

½-inch for hot and cold; 1¼-inch for waste.

24. Why is it usual to surround a wash-basin with wood-work, if wood-work is objectionable around other fixtures?

To add to appearance of fixtures, as exposed pipes and safes are unsightly in handsome rooms.

25. Of what is the kitchen sink usually made?

Cast-iron, plain or galvanized.

26. Why are lead-lined sinks objectionable?

Because not durable; hot water causes the lead to expand and buckle; besides easily worn out.

27. Are galvanized-iron sinks durable?

To some extent, but the galvanizing wears off, as does the enameling.

28. What objection is there to the use of soapstone?

They get dirty-looking.

29. Should the strainer be fixed or movable?

Always fixed.

30. What are the usual sizes of hot, cold, and waste pipes for kitchen sinks?

Five-eighths inch for hot and cold; two inches for waste.

31. Is an overflow necessary on a kitchen sink?

No.

32. Of what are pantry sinks usually made?

Tinned copper and earthenware.

33. How much should the copper lining weigh per square foot?

Sixteen ounces.

34. Is an overflow-pipe necessary?

Yes; as there is a plug to hold water in sink, the overflow becomes a necessity.

35. Of what size should the hot, cold, and waste pipes be?

One-half inch for supply; one and one-half for waste.

36. What is meant by a counter-sunk marble slab?

A slab where the border is raised all round to prevent water from flowing over.

WASH-TUBS.

37. What is the best kind of wash-tub?

The earthenware.

38. Are wooden tubs satisfactory?

They are durable and serviceable, but are absorbent, and in time get foul.

39. Would it be advisable to line a wash-tub with lead?

It would be difficult to keep clean, and lead would not stand hot water.

40. How large should the hot, cold, and waste pipes be?

Five-eighths inch for supply and two-inch for waste.

41. Is one waste-pipe sufficient for three tubs?

Yes, if two-inch is used.

REFRIGERATORS.

42. Where should the waste water of a refrigerator discharge?

Into a sink properly trapped, or into a pail; never into a waste or soil pipe.

43. Where must it not discharge?

Into a soil, waste, or sewer pipe.

44. Why?

Because sewer-gas is liable to enter refrigerator and poison the contents.

45. What is the proper size of a waste-pipe from refrigerator safe?

One-inch or one and one-fourth.

URINALS.

46. Is it best to have a large or small waste-pipe from a urinal?

So as to have as small fouling surface as possible and have the most effective flush.

47. Why?

As above.

(TO BE CONTINUED.)

RECENT VIOLATIONS OF THE NEW YORK PLUMBING LAW.

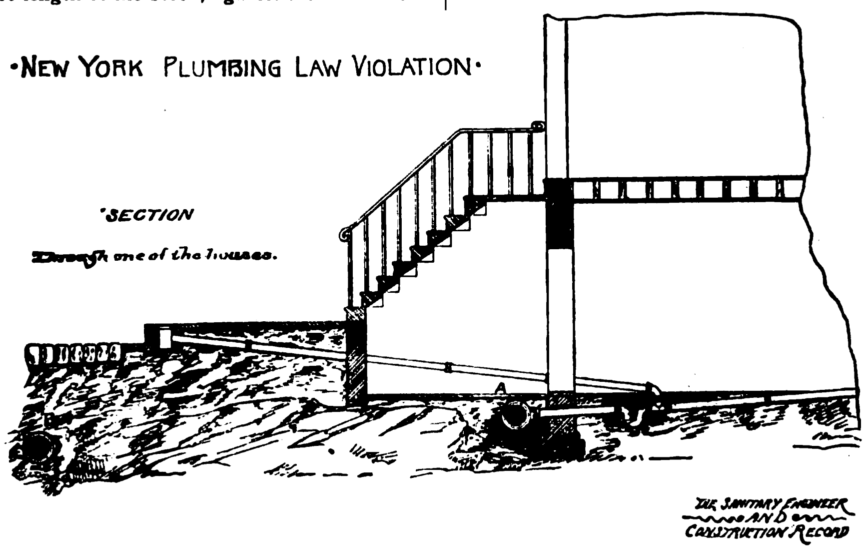
SOME months ago a row of twelve houses covering the block on the west side of Lexington Avenue, between One Hundred and First and One Hundred and Second Streets, was begun and pushed rapidly to completion. Ex-Alderman Michael Duffy, of boodle fame, was understood to be the real owner and builder, but for good and sufficient reasons it is stated preferred remaining *perdu*, and allowing a man named Daly to stand sponsor for the houses.

Plans and specifications of the plumbing and drainage were duly filed at the Health Department and the work went merrily on. Among the items in the specification, however, was one requiring each house to be separately and independently connected with the street sewer. Now it so happened that there was no public sewer in Lexington Avenue opposite the houses, and therefore this requirement could not be carried out. Nothing daunted, the builder proceeded to lay a private sewer of earthern pipe the entire length of the block, against the foundation-walls of the houses, as shown at A, and connecting with the public sewer in One Hundred and Second Street. As this was done without the permission of the Board of Health, and as the sewer would be inaccessible in case of breakage, when it would be liable to flood the cellars of the houses, a notice of violation was served on Daly. This not having the effect of stopping the work, an injunction was next obtained from Judge Van Brunt, but with a similar result. Then Daly was judged for contempt of court, and an order entered fining him $100 and directing that he be imprisoned till the fine was paid. In addition to this it was ordered that the violation be removed and that the private sewer be laid in accordance with the requirements of the Board of Health; failing in which that Daly be imprisoned until the order was complied with. Daly at last accounts was still languishing in the Tombs, and for reasons that will be apparent. The Board of Health ordered a new sewer to be laid outside the curb line, under the street-pavement and connecting with the public sewer in One Hundred and Second Street. This was done by the ex-Alderman, who, although understood to be the real owner by the authorities, could not be reached by the law department of the board. The sewer was, however, laid so near the surface that it would have been soon broken by the jarring occasioned by wagons passing over it; an order was therefore issued requiring it to be sunk to a proper depth. This was done, and the inspector notified to go up and approve the work. When he arrived he found the sewer had been covered in at two points, one at the lower end and the other about midway of the block. As the contractor refused to uncover the pipe, the law had to be again invoked; and well was it for the future tenants of the houses that this was done, for when the sewer was exposed it was found that no connection had been made with the public sewer, and that rather than to blast away a rock he found in the line of the pipe, the contractor stopped the sewer at one side and continued again on the other, as shown in the accompanying sketch.

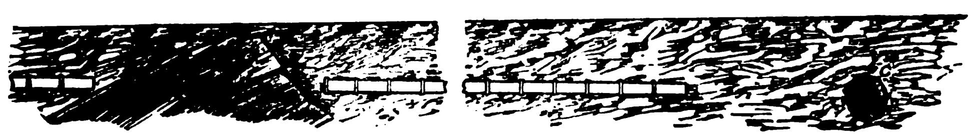
This was not all; for, although a new sewer was laid, the houses were not connected with it, so that had they been occupied, the sewage would never have reached it, but have gradually backed up and sooner or later caused illness in the houses. While all this was going on the old sewer A remained in place, and several of the houses at the upper end of the line having been sold and occupied, the sewage backed up and flooded the cellars of those at the lower end of the line. It may be said, however, that had not the force of inspectors charged with the inspection of new buildings been so reduced by the recent bad management of the Board of Health that the average length of time allowed to each building is four minutes, this disgraceful episode would probably never have happened.

Since the above was written, still further rascality has been unearthed by the authorities. In order to drain the cellars, a trench was dug through the row of houses midway between front and rear and connected with the sewer at the lower end. The drain itself was made of two joists set on end and covered with boards. In these latter holes were cut for each house, iron gratings set in, and concrete flooring laid over all. As, however, the drain was connected directly with the sewer, and the cellar gratings were untrapped, the blast of sewer-air into each house was sufficient to blow out a candle. To make matters worse, the furnaces were of the portable type, taking their air-supply from the cellar and being within five feet of the openings into the drain, would suck in sewer-air and discharge it through the registers into every room in the building.

It is a pity there is not some way by which such men could be prevented from carrying on building operations in this city.



Method of laying sewer B



REGULATION OF PLUMBING IN WASHINGTON, D. C.

THE Commissioners of the District of Columbia have issued the following:

WASHINGTON, April 6, 1887.

Ordered: A board to revise the plumbing regulations and to make provision for the examination of applicants for registration as plumbers is hereby constituted. The board will be composed of the Inspector of Plumbing, the Superintendent of the Water Department, and Dana C. Barber, Inspector of the Water Department, in conjunction with two master plumbers to be designated by the Master Plumbers' Association and to serve without pay.

The duties of the board will be to consider and prepare a revision of the plumbing regulations; to prepare

rules for the examination of plumbers for registration, establishing the proper qualifications; and to examine applicants.

The board will hold stated sessions at least once a month or as much oftener as occasion shall require. The Inspector of Plumbing will preside at the meetings of the board and Mr. Barber will act as Secretary.

The board will have its first meeting at 2 P. M., on Saturday, the 9th inst., at such office in the District headquarters as shall be found most convenient and practicable. The rules for the examination of plumbers and the establishment of qualifications will be completed as soon as possible, and submitted to the commissioners for consideration and action.

Thereafter the board will examine all applicants and make suitable recommendations to the commissioners in each case. In the preparation of the revision of the plumbing regulations, the board will hold meetings at least once a week and continue the work until completed for submission to the Commissioners.

CONVENTION OF THE NATIONAL ASSOCIATION OF BUILDING TRADES.

(From Our Special Correspondent.)

(Continuation of Report from page 464.)

AT the opening of the second day of the convention, a congratulatory telegram, dated Cincinnati, was read from President James Allison, of the National Plumbers' Association. Thomas J. King was greeted as a delegate from Washington. The rest of the morning was occupied in discussing and adopting a platform, among the more important points of which are the following:

The name selected is the National Assocation of Builders of the United States.

The fundamental objects of this association shall be to foster and protect the interests of contractors, manual workmen, and all others concerned in the erection and construction of buildings; to promote mechanical and individual interests; to acquire, preserve, and disseminate valuable information connected with the building trades; to devise and suggest plans for the presevation of mechanical skill through a more complete and practical apprenticeship system, and to establish uniformity and harmony of action among builders throughout the country. The better to accomplish these objects this association shall encourage the establishment of builders' exchanges in every city or town of importance throughout the country, and shall aid them to organize upon some general system that will not conflict with local customs and interests, in order that through these affiliated associations the resolutions and recommendations of their national association may be promulgated and adopted in all localities.

Builders' exchanges, one in each city, are declared eligible to membership, and individual members thereof shall be members of the national body. Meetings shall be held annually or oftener, and every local exchange shall be represented therein by one delegate at large, who shall be the director chosen at the preceding meeting, and one additional delegate for every fifty members or fractional part thereof. The initiation fee shall be $15 per exchange, and annual dues shall be assessed by each convention per capita of local membership, and paid through the local treasurer within thirty days after each national convention.

There shall be the usual officers—President, two Vice-Presidents, Secretary, Treasurer—and these shall be the Executive Committee; and also serve as directors along with one member at large from each city represented, who shall be named by his delegation. They may fill vacancies. The Secretary shall be salaried by the Directors. The President shall appoint, among other committees: (1) a Committee on Legislation, who shall observe, investigate, and report to the Board of Directors upon any proposed action by legislative bodies that may affect the interests of building; (2) a Committee on Statistics, to formulate plans for securing and disseminating valuable building statistics; and (3) a Committee on Resolutions, which shall have charge of the preparation of resolutions to be offered at conventions, and all resolutions sent in by members at large shall be submitted to this committee for revision before being offered to the convention for action.

Enlivening features at the afternoon session were invitations by President Prussing to a banquet the next evening, and by Mr. Scribner, of St. Paul, for a trip by special car after the convention up to the "twin cities," and everybody accepted the first and not a few the second.

The election of officers was then held and resulted as follows:

President, J. Milton Blair, Cincinnati.
First Vice-President, John S. Stevens, Philadelphia.
Second Vice-President, Edward E. Scribner, St. Paul.
Secretary, William H. Sayward, Boston.
Treasurer, John J. Tucker, New York.

Pleasant five-minute speeches followed from the new officers. Treasurer Tucker referred to the great benefits derived by the local association of builders in New York City, where the policy of the organization was to promote good feeling between employers and employees, with such success that now hardly a question arose that was not speedily settled by arbitration.

For the Cincinnati delegation President-elect Blair submitted a resolution that "the increasing demand for good mechanics in each branch of the building trades requires that the restriction now existing in the matter of the number of apprentices allowed by the present labor organizations be modified in the interest of employers and employees, and that manual training be instituted and encouraged by the various assemblies and trade organizations." Also another resolution directing the Legislative Committee, when constituted, to "examine the present lien laws of the several States for the purpose of reporting a lien law that can be presented to the Legislatures by the local organizations of each State with the view of obtaining a uniform law in all the States."

A. J. Campbell, New York, was opposed to the too frequent use of the word "master" in connection with trade organizations, since it was a relic of slavery.

George Roydhouse, Philadelphia, wanted uniformity in the constitutions of local associations.

Weaver, of Indianapolis, favored a uniform system of measurements.

P. B. Wight, Chicago, then read an elaborate essay on "Building Contracts," arguing for uniformity, and characterizing the present systems as absurd. In the course of his remarks he said: "The majority of the contracts may be fairly drawn, but the fault is in the variation. There is an old theory that the architect is a sort of middleman or umpire to stand between the owner and contractor and see that both get their rights. This is only a theory. It is not the fact. It is not the law. It is not to the discredit of the architectural profession that it is not. The architect is the agent of the owner. The courts have so decided. He is paid by him, and only by him if he is an honest man. An architect's certificate is as good in law as a bill of exchange, a draft, or a promissory note. He is, therefore, doing his duty when he is looking after the owner's interests. The contractor is doing his duty to himself by looking after his own interests. If he expects the architect to do this he is very much mistaken. The body of contractors should agree with the body of architects as to what the form of all contracts should be." In conclusion Mr. Wight presented the following resolutions, and they were referred to the committee thereon:

Whereas, It is desirable:

1. That all blank forms of contracts for buildings should be uniform throughout the United States;

2. That such forms of contract, with the conditions thereof, should be such as will give the builder as well as the owner the protection of his rights, such as even justice demands;

3. That whenever a proper form has been approved by this association, it is the duty of every builder and contractor to insist on its use in every case; and

Whereas, In a spirit of fairness the American Institute of Architects has framed such a form of contract as has seemed to it proper, and has asked its members to use it; and

Whereas, The Western Association of Architects has appointed a committee on uniform contracts and specifications to report at its next annual meeting; therefore,

Resolved—1. That a committee of ten be appointed by the President to confer with the Board of Trustees of the American Institute of Architects, or if the same should not be satisfactory to the committee such a modification of it as would appear to them to deal justly with builders and contractors in general, as well as with the owners and architects.

2. That in case such a conference is had the special committee of the Western Association of Architects on uniform contracts and specifications be invited to join the same before taking further action.

3. That in case no further action is taken by the Board of Trustees of the American Institute of Architects, the special committee of the Western Association be asked to confer with this committee with the objects in view as expressed in this preamble and resolutions.

4. That the committee report such forms of contract as may be approved by the conference for adoption by this association at its next annual meeting.

Thanks were voted Mr. Wight on motion of Mr. Sayward.

The Chair said steps had been taken by the Master Masons' Association of Chicago in a similar direction, also Boston had taken some such action.

On motion the paper of Mr. Wight and also the Chicago and Boston contributions were referred to the Committee on Resolutions.

At night theatre parties were the order.

The third and closing day's session of the convention was opened with the announcement of the following gentlemen as the Board of Directors and delegates at large to the next annual convention: Cleveland, Thomas Simmons; Cincinnati, James Allison; Philadelphia,, William Harkness, Jr.; New York, Marc Eidlitz; Boston, Leander Greeley; Baltimore, William Ferguson; Buffalo, Charles Berrick; Troy, C. A. Meeker; Worcester, E. B. Crane; Providence, George R. Phillips; Pittsburg and Allegheny City, Samuel Francis; Columbus, Thomas E. Knauss; Indianapolis, William P. Jungclaus; Detroit, W. G. Vinton; Grand Rapids, W. C. Weatherly; New Orleans, F. H. West; Charleston, Henry Oliver; Nashville, J. N, Phillips; Milwaukee, Thomas Mason; Minneapolis, H. N. Leighton; St. Paul, E. F. Osborne; Sioux City, Fred F. Beck; Chicago, George C. Prussing. St. Louis, Albany and Rochester appointed no delegates. The only sections of the report of the Committee on Resolutions that did not pass by acclamation were two, the first relating to the protection of workmen "by properly covering the entire surface of open floors," which clause was stricken out, and the second relating to a system of insurance against injury, the section finally passing by a two-thirds vote. In substance the report was as follows: It recommends favorably to the Executive Committee the three resolutions in behalf (1) of uniformity of measurements, (2) of uniformity of constitution and by-laws for affiliated associations, and (3) of eliminating the word "master." The other resolutions—seven in number—introduced into the convention are returned with the recommendation that they be accepted in the form of an accompanying declaration of principles, in which is preserved as completely as possible the original wording, said declaration of principles being as follows:

This association affirms that absolute personal independence of the individual to work or not to work, to employ or not to employ, is a fundamental principle which should never be questioned or assailed; that upon it depends the security of our whole social fabric and business prosperity, and that employers and workmen should be equally interested in its defense and preservation. While upholding this principle as an essential safeguard for all concerned, this association would appeal to employers in the building trades to recognize that there are many opportunities for good in associations of workmen, and while condemning and opposing improper action upon their part, they should aid and assist them in all just and honorable purposes. That while upon fundamental principles it would be useless to confer or arbitrate, there are still many points upon which conferences and arbitrations are perfectly right and proper, and that upon such points it is a manifest duty to take advantage of the opportunities afforded by associations to confer together, to the end that strikes, lockouts, and other disturbances may be prevented. When such conferences are entered into, care should be taken to state clearly in advance that this fundamental principle must be maintained, and that such conferences should only be competent to report results in the form of revolutions of recommendation to the individuals composing the various organizations participating, avoiding all forms of dictatorial authority.

That a uniform system of apprenticeship should be adopted by the various mechanical trades.

That manual training-schools should be established as a part of the public school system; that trade night-schools should be organized by the various local trade organizations for the benefit and improvement of apprentices.

This association earnestly recommends all its affiliated associations to secure as soon as possible the adoption of a system of payment by the hour for all labor performed, other than piece work or salary work, and to obtain the co-operation of associations of workmen in this just and equitable arrangement.

That all blank forms of contracts for building should be uniform throughout the United States.

That such forms of contract, with the conditions thereof, should be such as will give the builder, as well as the owner, the protection of his rights, such as justice demands.

That whenever a proper form has been approved by this association after consultation with the American Institute of Architects and the Western Association of Architects, we recommend its use by every builder and contractor.

The Legislatures of the various States should be petitioned to formulate and adopt uniform lien laws, and every organization represented in this association is recommended to use its best endeavors to secure the passage of the same.

Architects and builders should be required to adopt more effectual safeguards in buildings in process of construction, so as to lessen the danger of injury to workmen and others.

We recommend the adoption of a system of insurance against injuries by accident to workmen in the employ of builders, wherein the employer may participate in the payment of premiums to the benefit of his employees; also in securing the payment of annuities to workmen who may become permanently disabled through injuries received by accidents or infirmities of old age.

Thanks were voted, on motion of George Tapper, of Chicago, to the officers and the press, and like courtesies extended to the Chicago Exchange. A per capita tax of $2 per year on each member of the primary bodies was recommended by President Prussing, Chairman of the Committee on Assessments, and after much debate adopted. A telegram from the Cincinnati Exchange expressed pleasure that the next convention is to meet there. A resolution by Mr. Stevens, of Philadelphia, recommended co-operation with Western Association of Architects in their efforts to secure legislation regulating, in the interest of public health, the designing and erection of buildings. Referred to the Executive Committee. Quite a little breeze was caused by Mr. King, of Washington, who offered a resolution to debar from participation in future conventions all associations whose membership represented only one branch of the building interest. The resolution was finally referred to the Executive Committee. On the eve of adjournment *sine die*, the new president, J. Milton Blair, of Cincinnati, in a neat speech expressed the hope that when they met next February, in Cincinnati, they would renew the good fellowship fostered in Chicago. The last act of the convention was to give three rousing cheers for Secretary Sayward.

In the evening a banquet at the Grand Pacific Hotel was given the delegates by the Builders' and Traders' Exchange, of Chicago, George Tapper, President of the Exchange, welcoming the guests, and toasts being responded to by Messrs. Sayward, Blair, and others.

AN effort will be made in the City Council of Detroit, Mich., to pass ordinances requiring the telephone and telegraph wires to be put underground within a radius of four miles from the City Hall.

LOS ANGELES, CAL., IMPROVEMENTS.

(From an Occasional Correspondent.)

LOS ANGELES, CAL., March 26, 1887.

THE Electric Railroad, which has for some time been completed and operated for a distance of two miles, is doing very well and may be considered a success. The company is now at work to extend the road to the Plaza, which wil bring it to the heart of the city.

The principal street-railroad companies are wrestling witl the city authorities to get permission to change their lines into cable roads; this would nearly do away with the horse railroads in this city. We have already two cable lines traversing the hilly portions of our city for several miles. At right angles to the present cable-roads a narrow-gauge (3 feet 6 inches) railroad is under way, which will curve around many steep hills and reach at last the ostrich-farm, about six miles north of the city on the Los Angeles River.

The city has at present lands surveyed for a sewage-farm. It is about thirteen miles south of the city, and is close to the ocean. The sewage will be used for irrigation. A tunnel of about 6,000 feet in length will be necessary to convey the sewage to the lands in view. A big fall can be secured for the outfall sewer, as well as for all mains.

The Atchison, Topeka, and Santa Fe Railway Company is constructing a level about one mile in length at the west side of the Los Angeles River, in order to protect their grounds, where the intended depot buildings and railroad shops will be erected. The level will be built of piles and planks, with anchor-piles, and a shed of fascines behind the planking; fascines to be located four feet underground, and be covered with a dam (behind the bulkheads), ten feet in width on top and forty feet on the bottom.

During the last year the brickyards were not able to fill their contracts; the demand for brick was immense. Millions of brick are already contracted for, and it keeps the Chinese busy for times to come. We make no pressed brick here. We have about seventy miles from the city, on the Southern Pacific Railroad, the finest fire-clay one may expect to find on the globe. It is very little used.

MAKING A WET CELLAR DRY.

NEW YORK, March 22, 1887.

SIR: I intended before this to give you my experience in making a wet cellar dry, in response to query on page 219, issue of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, but a gentleman who professes to know a great deal about Portland cement and asphalt informed me that my scheme was impracticable; that the combination of asphalt and Portland cement had a disintegrating effect, the acid in the asphalt eating up the vitality of the Portland cement. Under such information I hesitated to reply to your letter.

The plan adopted by myself in making a cellar dry and damp-proof was a similar plan as suggested by you in reply to a letter from Yonkers, dated January 1, 1887.

The cellar of the house, for which I acted as agent, was constantly covered with water, and I could not find out from what source it came. I dug in the most compressed part of the cellar, which was the north-west corner, a cistern four feet deep, which I lined and ceiled with brick, and then connected this cistern with drain-pipe, sealing their joints with Portland cement, neat, giving an incline of about one inch in two feet. I laid the drain-pipe about six inches from the surface, so as to have about thirty-six inches of depth of the well, as my drain-pipe was a 6-inch pipe, and connected this drain-pipe with the street-sewer. I then covered up my drain-pipe and laid a clean floor of Portland cement, 1 cement and 3 sand, and then coated that with Trinidad asphalt, say one-sixteenth of an inch, and then laid over that one inch of Portland cement, ½ sand ½ cement. I then coated my inside walls with Trinidad asphalt, say four feet, but making the thickness of the coating about one-sixty-fourth of an inch.

Since then I have had a perfectly dry cellar. I have seen no disintegration in cement from the combination of the asphalt. This Portland-cement-asphalt cellar cost me $100, whereas the men engaged in Portland cement cellar business in New York City wanted $400 for the same job. The principle involved in my work seems to be the same as illustrated by your guidance to the Yonkers letter.

Yours truly, S. L. MERCHANT.

COMPARATIVE COST OF MILL CONSTRUCTION.

CHICAGO, March 26, 1887.

SIR: We would like to obtain a knowledge of the comparative cost of building, using mill construction as it is ordinarily done (without plastering) and building with ordinary joists, double floors and lath and plaster, and what further increase there would be to finish mill construction, as described in your "Building Construction Details" of March 19. Yours, INTERESTED.

[Through the courtesy of Peabody & Stearns, the architects of the building our correspondent refers to, we are permitted to state that in estimating bids were received for the erection of the Unitarian Building both with and without the mill-framing. It was found that the carpenter work for the mill-frame was about 2½ per cent. higher than for an ordinary frame. The plaster-work was about 25 per cent. higher than for common level ceilings, and the cost of the entire finished construction as shown by the cut in our issue of March 19, including hoop furrings, plaster and wood-work, was about 8½ per cent. higher than for ordinary frame and plastering. Mechanics not accustomed to this kind of work would probably figure higher. For floors of equal strength the beam-work is no more expensive with one system than with the other, but with a mill-frame the heavy planking adds somewhat to the expense.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
April 2........ ..	25.76	19 84	20.90	29.12	26.27	24.52	30 76

E. G. LOVE, Ph.D., *Gas Examiner.*

THE city of Newark, N. J., has accepted the offer of the Thomson-Houston Electric-Light Company to place electric-lights on Broad Street, and maintain them for one year free of cost to the city.

BIDS for lighting the streets of New York City were opened March 30, as follows: the Consolidated Gas Company and the Mutual Gas Company, $17.50 per lamp; the Equitable Gas Company, $12; the Central Gas Company, $28; the Northern and Yonkers, $30; the New York and New Jersey Globe Light Company, $25. The Brush and United States Electric-Light Companies each bid 65 cents per lamp per night for 2,000-candle-power lights; the Harlem Electric-Light Company, 48 cents per 2,000-candle-power lights, except for lights in Mount Morris Park and on Harlem Bridge, these to be 70 cents, and for 16-candle-power lights on lamp-posts, 5 cents per lamp per night; the North New Y rk Electric-Light Company, 55 cents for 2,000-candle-power lights. A contract was awarded to the Equitable Company to light as much of the city as it can, and the rest of the gas-lighting will go to the Consolidated and the Mutual. The Central Company has the contract for the Twenty-third Ward. The bids on the electric-lighting and the other gas bids were held for further consideration.

THE following figures concerning the illuminating gases of this city are abstracted for THE SANITARY ENGINEER AND CONSTRUCTION RECORD from the report of the Gas Examiner for the quarter ending March 31, 1887:

	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
Average Illuminating-power for the quarter...........	25.06	19.89	20.89	29.74	29.03	22.40	31.73
Sulphur, grs. in 100 cubic feet..........	5.31	13.74	17.72	5.06	2.78	3.91	4.12
Ammonia, grs. in 100 cubic feet..........	0.16	4.15	1.88	0.20	0.15	0.40	0.16
Specific gravity.....	.633	.477	.497	.720	.642	.596	.658

THE Municipal Council of Paris have finally rejected the proposition of one of its members, M. Donnat, which was brought forward nearly a year ago, and which was intended to bring the gas company to terms by depriving it of the monopoly which it enjoys.

A "YEAR-BOOK" recently published by Macmillan contains a table of the miles of telegraphs in the different countries of the world. According to this, Europe has a total of 328,281 miles; Asia, 42,308; America, 247,183; Africa, 18,220, and Australia 36,098. Great Britain and Ireland have 30,276 miles; Germany, 51,869; France, 61,286; Russia, 68,611, and the United States, 164,954 miles.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

A SYPHON-CISTERN ATTACHMENT.

WE illustrate a syphon-cistern in which the syphon is started by touching a "push." A brass push is provided, which should be fixed on the wall of the water-closet.

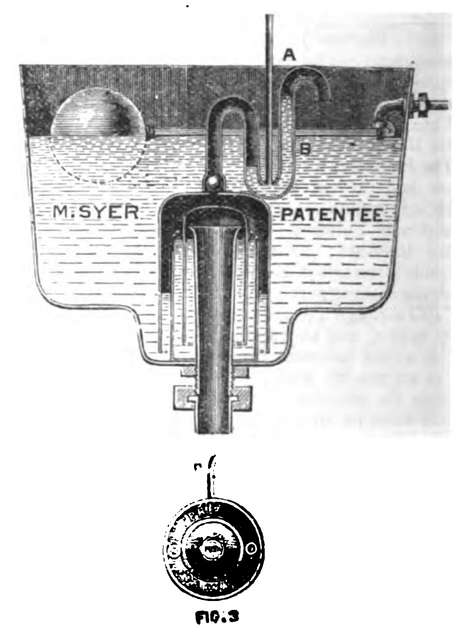


FIG.3

Connection is made between this "push" and the cistern by means of a small air-pipe of $\frac{1}{16}$-inch bore. One end of this pipe is soldered or joined, by means of a rubber tube, to the pipe (A) in cistern; the other end is fixed to the pipe on "push." To put the syphon in action the "push is pressed in; no constant stream of water can be obtained, as the "push" must be released and pressed again before a second supply can be obtained. The action of pressing "push" blows the trapping water out of bent tube (B) and allows the confined air to escape from under syphon cover, thus starting the syphon. The inventor is Milton Syer, of England. The United States patent is in the hand of James H. Lancaster, 187 Broadway, New York.

MEETING OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

AT the meeting on Wednesday evening the following gentlemen were elected to membership as stated:

For members—Horace Andrews, City Engineer and Surveyor of Albany, N. Y.; Frank Graef Darlington, Superintendent Cincinnati and Muskingum Railway, Zanesville, O.; Joseph Thompson Dodge, Chief Engineer Montana Central Railway, Helena, Mont.; Edward Adolph Hermann, Assistant Engineer Cincinnati, Indianapolis, St. Louis and Chicago Railway, Indianapolis, Ind.; Henry Clay Jennings, Assistant Engineer, Chicago, Milwaukee and St. Paul Railway, Milwaukee, Wis.; Samuel Fisher Morris, Assistant Engineer in charge Section 9, New Croton Aqueduct, Yonkers, N.Y.; Benjamin Franklin Thomas, U. S. Assistant Engineer in charge Big Sandy River, Louisa, Ky.

For Juniors—George McGrew Farley, Engineer Maintenance of Way Northwestern Ohio Railroad, Toledo, O.; Gideon Frederick Haynes, Advisory Engineer Mills of

William Roberts, Assoc. Am. Soc. C. E., Waltham, Mass.

The remainder of the evening until a late hour was occupied in a discussion of Mr. Metcalf's paper entitled, "Steel: some of its properties, its use in structures and heavy guns."

Lieutenant Jacques, of the Navy, read a discussion in which, while speaking in the higest terms of Mr. Metcalf as an expert, he dissented from his views on certain points. The offer of the Bethlehem works to make the steel required under the recent competition, he considered a guarantee that the system of building up steel guns is the best.

He considered the Terre Noire experiments as also proving that a steel gun cannot be cast successfully. He asked Mr. Metcalf why if hammering and rolling were not beneficial, he resorted to these processes so universally in his own shops. To this Mr. Metcalf replied, that they were called upon for about 6,000 sizes and different shapes, and hammering and rolling were the most economical methods for producing them. He did not believe there was any beneficial effects resulting.

A written discussion by Dr. R. J. Gattling followed, upholding Mr. Metcalf's views, that gun-steel should not be hammered, pointing out the dangers from overheating and overannealing, etc.

Mr. A. H. Emory gave orally some statistics as to charges of powder, weight of projectiles, muzzle velocity obtained with cast-iron guns and that now required. He also pointed out the effect of heavy powder pressures in causing a flow of the metal surrounding the powder-chamber where soft steel is used, and the utter impossibility of constructing guns of this material to withstand such pressures.

Mr. Theodore Cooper controverted some of the statements made by Mr. Emory.

Mr. F. Collingwood read a brief paper expressing the opinion that when experts such as Mr. Metcalf expressed so positive an opinion respecting the possibility of casting large guns successfully on the Rodman plan, it was un-American for us to blindly follow the lead of other nations without first following the lead of our *own* traditions, and proving the truth or falsity of Mr. Metcalf's position by actual test.

A lengthy paper, by Mr. John Coffin, was partly read, which was largely illustrated by diagrams, treating mainly on the condition of carbon in steel as modified by working.

Mr. Metcalf replied to the discussion, expressing disappointment that it had gone so much in the direction of gun manufacture. He referred to other parts of the discussion not yet read, showing variations in carbon utterly disproving the conclusions reached by Mr. Coffin. His interest does not lie in gun manufacture, but in the use of steel structurally.

He had pointed out four or five fundamental facts as a result of the manufacture of steel and testing it during twenty years, and he presented them for the use of the profession and an advance in the intelligent use of the material by engineers.

BOSTON SOCIETY OF ARCHITECTS.

AT the monthly meeting of the Boston Society of Architects, April 1, no action was taken or suggested concerning the recent award to a New York firm of architects of the construction of the new Library Building. So far as any expression was made by individual members in the familiar discussion, it was not in the tone of criticism or lamentation. It was rather the other way, that since the trustees thought it well to engage with parties outside of Boston, a matter for congratulation they had chosen so wisely and had selected architects who are entirely competent to do the work worthily.

STORAGE OF MANURE.

AT the meeting of the New York City Board of Health on March 15, the section of the Sanitary Code relating to the keeping of manure was amended so as to read as follows:

SECTION 100. That every owner, lessee, tenant, and occupant of any stall, stable, or apartment in which any horse, cattle, or swine, or any other animal shall be kept, or of any place in which manure or any liquid discharge of such animals shall collect or accumulate, within the built-up portion of said city, shall cause said liquid and manure to be at once removed to some proper place, and shall at all times keep or cause to be kept such stalls, stables, and apartments, and the drainage, yard, and appurtenances thereof, in a cleanly and wholesome condition, so that no offensive smell detrimental to health shall be allowed to escape therefrom; and when within three hundred feet of any occupied dwelling-house, or of any manufactory where more than five persons are employed, the removals from the stables shall not be made, nor shall the manure or refuse from the stable be allowed to remain on any street or place near such stable, any time between 8 o'clock A. M. and 11 o'clock P. M., without a permit from this board. Whenever there shall be a cart-load of manure on any premises it shall be immediately removed, unless it be pressed or baled. The Sanitary Superintendent may issue permits for and regulate the removal of baled or pressed manure upon conditions stated in such permits, which shall prescribe not more than ten days for such removal, and shall prevent a nuisance. No manure-vault under the sidewalk shall be built or used. No manure-vault or receptacle outside of a stable shall be built or used on any premises, except pursuant to the terms of a permit granted therefor by the Health Department.

REPORT OF THE WATER COMMISSIONERS OF WATERBURY, CONN.

THIS is the twentieth annual report, and shows the present state of the work to be as follows:

There are now in use 182,851 feet of pipe, of which 94,257 feet are the so-called cement pipe, and 88,594 are iron. The largest cement pipe is 16 inches. There are 188 hydrants owned by the city and 36 private hydrants; 4,333 feet of pipe (mostly of cement), ranging from 1½ to 12 inches, was taken up, and its use discontinued, during the year, and 9,368 feet of 4-inch to 16-inch iron pipe was laid. There are now in use 123 meters. The total number of service-pipes is now 2,751, of which 121 were added during the year, and the total of rents collected for the year was $45,051.27, an increase of nearly $4,000 on the year previous, notwithstanding a reduction of one-third on many of the rates charged previously. The total expense account for the year, except for new work, was $44,004.31. The average receipts per tap were $16.38.

The total cost of the works to date is $434,485 68, and an extension of mains (8,830 feet of 16-inch and 18-inch pipe) is now in progress, at an estimated cost of $37,500.

Attention is called to the law requiring the fire-hydrants to be opened *only* by firemen, and for actual use at a fire, as the careless closing renders them subject to damage by frost, or rupture by shock. Much of the repairs to pipes is made necessary by careless support while making sewer connections, or careless filling of trenches.

DISINFECTION OF DWELLINGS AND OF INHABITED ROOMS.

DRS. GUTTMANN and Merke, of the City Hospital Moabit, in Berlin, have made an investigation as to the relative value of various methods of disinfecting inhabited rooms, and have published the results in a paper in *Virchow's Archiv* of March 2, 1887. The main points kept in view in the inquiry were that a satisfactory method should destroy the vitality of bacteria, should not injure the house or furniture, should not be dangerous to the health of the person in the house or of the person applying it, should involve the least possible labor in its use, and be as cheap as possible. The bacillus anthrax was taken as the test organism, and was dried in silk fibres and scattered through the room, on the rugs, etc. Disinfection was attempted by rubbing the floors, ceilings, and walls with disinfectant fluids and by spraying the same on the rugs, etc. The solutions experimented with were a five per cent. solution of carbolic acid, and solutions of bichloride of mercury of various strengths. Their conclusion is that a solution of bichloride of mercury, 1 to 1,000, used as a wash and a spray, is the most certain, the cheapest, and in all respects the best for disinfecting inhabited rooms.

RAPID TUNNEL WORK.

WE recently mentioned some rapid tunneling work at Shaft 15 on the new Croton Aqueduct where the average was 12.4 feet per day. Mr. John Barron, the foreman, has beaten this record, which he made last January. The work was at the south heading of Shaft 15, and was a progress of 102.1 feet in the week, from the 19th to 26th of February, with three Rand Slugger Drills No. 13 in thirteen shifts, using rack-a-rock powder and working their ordinary force of men, thus being put to no extra expense. The heading was 9x17 feet, and they fired thirteen shots. The character of the rock is a hard quartzitic gneiss. The heading bosses under Mr. Barron were Mr. William Johns and Mr. Patrick Haley. This section has recently been put under charge of Messrs. Paige, Carey & Co., who thus inaugurate their work with the biggest weekly run on record. The same gentlemen are driving Section 9, and their foreman, Mr. Frank Moran, won last year the prize of $300 at Shaft 18½. No extra labor was employed in running this remarkable 102 feet. A little more energy and pushing of the drills was all.

AS THE result of a series of experiments to determine the extent to which bacteria may be carried upward in a porous sandy soil by water rising by capillary attraction, Professor Soyka, of Prague, concludes that bacilli of various kinds may be thus raised at least twenty centimetres.

AN ordinance is on its passage in the Little Rock, Ark., City Council, requiring all sewerage, water, and gas pipes to be laid in streets before paving is done.

PERSONAL.

MAJOR W. R. KING, U. S. Engineers, has been assigned to duty as a member of the Board of Engineers for Fortifications and River and Harbor Work. This assignment is in addition to his present duties.

SUPERINTENDENT GRAHAM, of the Northern Pacific Railroad, was on April 3 elected Mayor of Jamestown, Dak.

MR. ALAN MACDOUGALL, M. Inst. C. E., has been appointed Assistant City Engineer, of Toronto, Canada.

MR. AUSTIN CORBIN has been elected president of the New York, Woodhaven, and Rockaway Railroad, to fill the vacancy caused by the death of Mr. James M. Oakley.

H. BEEKMAN, a farmer living near Cleveland, O., has just been convicted of selling watered milk. The health officer discovered that almost one-half was water. The culprit was fined $5,000 and costs. Judge Hutchins, in passing sentence, remarked: "The honest farmer was imposing on the credulous city people, and the thing had to be stopped."

Patents.

357,692. Automatic Fire-Extinguisher. Daniel C. Stillson, Somverville, and Edwin Prescott, Arlington, Mass.; said Presscott assignor to said Stillson. Filed August 16, 1884. Serial No. 140-777. Issued February 15, 1887.

357,729. Rock-Drilling Device. Thomas Murdock, Middletown, Conn., assignor to the Knox Rock Blasting Company, Pittsburg, Pa. Filed July 22, 1886. Serial No. 208,726. Isued February 15, 1887.

357,730. Method of and Means for Blasting out Rock Corners. Thomas Murdock, Middletown, Conn., and John L. L. Knox. Allegheny, Pa., assignors to the Knox Rock Blasting Company Pittsburg, Pa. Filed July 22, 1886. Serial No. 208,727 Issued February 15, 1887.

357,733. Street-Receiver and Stench-Trap. Thomas J. O'Brien Buffalo, N. Y. Filed November 6, 1886. Serial No. 218,151 Issued February 15, 1887.

357,769. Hot-Air Heater. William H. Hains, Sheldon, Vt., assignor of one-half to Weston C. Marsh, same place. Filed March 29, 1886. Serial No. 197,002. Issued February 15, 1887.

357,793. Heating-Apparatus. John G. Smith, Montreal, Quebec, Canada, assignor to Garth & Co., same place. Filed April 19, 1886. Serial No. 199,301. Issued February 15, 1887.

357,803. Water-Closet. Peter White, St. Louis, Mo. Filed January 22, 1885. Serial No. 153,678. Issued February 15, 1887.

357,804. Trap for Basins and Sinks. Peter White, St. Louis, Mo. Filed July 19, 1886. Serial No. 208,401. Issued February 15, 1887.

357,838. Electric Temperature-Regulator. Charles E. Lee, Rochester, N. Y. Filed January 9, 1886. Serial No. 188,055. Issued February 15, 1887.

357,857. Self-Dumping Scow. James S. Rogers, Rockport, Mass. Filed September 23, 1886. Serial No. 214,332. Issued February 15, 1887.

357,874. Water-Heating Device for Stoves and Ranges. Robert J. Stirrat, St. Louis, Mo., assignor of one-half to Robert G. Stirrat, same place. Filed October 23, 1883. Serial No. 109,765. Issued February 15, 1887.

357,876. Eaves-Trough. George W. Taylor, Castile, N. Y. Filed November 2, 1886. Serial No. 217,791. Issued February 15, 1887.

357,880. Dredging-Machine. John E. Walsh, New York. Filed March 17, 1886. Serial No. 195,510. Issued February 15, 1886.

357,894. Boiler Attachment. Edward F. Barber, Ionia, Mich. Filed December 15, 1886. Serial No. 221,646. Issued February 15, 1887.

357,908. Water-Closet. John Clifford, Chicago, Ill., assignor to the L. Wolff Manufacturing Company, same place. Filed December 12, 1885. Serial No. 185,460. Issued February 15, 1887

357,934. Feed-Water Heater Francis M. Ludlow, St. Louis, Mo. Filed April 19, 1886. Serial No. 199,556. Issued February 15, 1887.

357,962. Regenerative Gas-Lamp. Charles M. Lungren, New York, N. Y. Filed February 20, 1886. Serial No. 192,632. Issued February 15, 1887.

357,992. Fire-Place Heater. Adam H. Hewitt, Waynesburg, Pa., assignor of one-half to G. W. Hewitt, same place. Filed February 18, 1886. Serial No. 162,339. Issued February 15, 1887.

Contracting News Department.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

Proposals.

(Continued from page 480.)

WATER-PIPE, etc. Until April 14. Quantities as follows: 7,416 feet of 4-inch cast-iron water-pipe, 1,860 feet of 8-inch cast-iron water-pipe, 6,000 pounds pig lead, 350 pounds jute packing, 14 4-inch Eddy street stop-valves, 2 6-inch Eddy street stop-valves, 3 8-inch Eddy street stop-valves, 5 4-inch cast-iron tees, 2 (6-inch x 4-inch) cast-iron tees, 1 six-inch cross-head branch, 3 8-inch cast-iron tees; for digging and filling trenches two feet wide, 4 feet deep, per lineal foot, the aggregate length of which equals 11,123 feet. James A. Beamer, James Torrens, Levi Geesey, Thos. H. Wiggins, Board of Water Commissioners, Altoona, Pa.

LIGHTING the streets of the borough of Pottsville, Pa., every night in the year, from sunset to sunrise, with eighty electric arc-lights of 2,000 candle-power each. Also, for lighting the streets by gas or incandescent lights of 16 candle-power each. Also, for an electric-light plant, complete, of 80 arc lights of 2,000 candle-power each. Also, for an electric-light plant, complete, of 60 arc lights of 2,000 candle-power each, to be placed upon twelve towers, 125 feet high, five lights to each tower, and the towers to be erected under the direction of the Lamp and Watch Committee, in conjunction with Borough Surveyor. All proposals will be handed to the Town Clerk on or before the 17th day of May, 1887. C. H Parker, Chairman Lamp and Watch Committee.

PASSENGER ELEVATORS, Washington, April 6. Propcsals will be received until April 23 for furnishing two hydraulic elevators at the United States Capitol. Address Edward Clark, Architect of the Capitol, Washington, D. C.

MASTER BUILDERS IN ST. PAUL.

(From our Special Correspondent.)

St. Paul, April 4.—The Contractors' and Traders' Association of this city invited the members of the Master Builders' Association, lately in session in Chicago, to visit St. Paul. The following party arrived Friday morning: George F. Kessan, M. W. Powell, M. Benner, George C. Furst, Chicago; John A. Emery and wife, Leander Greeley, Francis Hayden, William Lamb, J. Arthur Jacobs, Ira G. Hersey, W. H. Sayward, Boston; Harry Oliver and wife, D. A. J. Sullivan, Charleston; William T. Harkness, Jr., J. S. Stevens, George Watson, C. H. Reeves, William Gray, A. P. Shannor, Philadelphia; C. H. Petor, Grand Rapids; H. M. Levy, C. C. Fowler, J. Ober, M. D. Quitman, New York; H. J. McKennie, Cleveland; C. F. Leigh, Hartford. An informal reception and lunch at the Hotel Ryan in the afternoon was followed by a visit to various points of interest in the city and suburbs. In the evening a banquet was spread—covers being laid for 100—preceded by a formal reception. The toasts proposed and responded to were as follows: "Welcome," E. Scribner and Mayor Smith; "Building," W. H. Sayward, of Boston; "St. Paul," C. D. O'Brien; "The Guests," John C. Stevens, of Philadelphia.

TRADE CATALOGUES.

Mr. George B. Cobb, 88 Chambers Street, New York, General Eastern Agent of Pierce, Butler & Pierce Manufacturing Co., of Syracuse, has issued a small forty-page pamphlet, illustrating and describing the Florida Steam-Heater.

The Duplex Steam-Heater Co., 10 Barclay Street, New York, have issued a catalogue illustrating and describing the Duplex Automatic Steam-Heaters for churches, buildings, green-houses, etc., manufactured by them.

The Builder's Iron Foundry, Providence, R. I., and 94 Liberty Street, New York, have sent us their illustrated catalogue and price list of globe special castings.

St. Paul.—Articles of incorporation have been filed with the Secretary of State as follows: The Beaver Falls, Redwood Falls and Sioux Falls Railway Company, to be known as the "Three Falls Railway Company." The line is to run from Hutchinson, Minn., through Beaver Falls and Redwood Falls to Sioux Falls, in Dakota. Principal place of business, Redwood Falls.

The Edison Electric Light and Power Company of Minneapolis. Capital stock, $400,000. The incorporators are: A. F. Rockwell, William N. Morgan, Donnell Rockwell, Harris Richardson, of St. Paul. These with Samuel Crozier, Jr., form the Board of Directors.

The North-western Natural-Gas, Oil and Mining Company. The general nature of the business shall be the boring or drilling of wells for natural-gas and oil; distributing the same by pipe-lines or otherwise; sinking of shafts for coal, erecting buildings, etc. Principal place of business, St. Paul. Capital stock, $500,000. Incorporators, W. G. Hunter, Pittsburg, Pa.; Hugh Bradley, St. Paul. These constitute the first Board of Directors.

CONTRACTING INTELLIGENCE

Persons who make any use of the information they find in these columns we trust will not omit to mention The Sanitary Engineer and Construction Record as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.*

For works for which proposals are requested, see also the "Proposal Column," pages 479-480.

CONSTRUCTION.

WATER, SEWERAGE, ETC.

Chambersburg, Pa., will hold a city election this spring on the question of extension of the water source.

Pittsburg, Pa.—City Engineer Bigelow is making plans for several miles of new sewers.

Milwaukee, Wis.—In the State Legislature are bills providing for expenditures as follows: For intake at water-works, $250,000; for intercepting sewers, the Menomonee sewer system, $100,000; for school purposes, $200,000; for erecting bathing-houses, $25,000; for Menomonee Valley viaduct, $250,000; for park purposes, $200,000. This makes a total of $1,025,000.

Buffalo.—On next Thursday the Water-Commissioners of Buffalo, N. Y., will open bids for a pumping-engine of 15,000,000 to 20,000,000 gallons capacity in twenty-four hours.

San Antonio, Tex.—The Council has directed the appointment of a sewer committee, and it is expected the project for a comprehensive sewerage system will be revived and carried through.

Fernandina, Fla., City Council on March 24 adopted specifications for water-works, and the city clerk will advertise for proposals at once.

Memphis, Tenn.—The Legislative Council has decided to grant to Mr. R. C. Graves the right to open the streets for the laying of water-mains, the supply to be obtained from driven wells, provided Mr. Graves succeeds in obtaining a sufficient quantity of water from that source. Mr. Graves has been sinking wells for some time.

Little Rock, Ark.—Sewer District No. 12 has applied for permission to put in about two miles of sewers.

The Waterloo, Iowa, Water Company will lay water-mains next month.

The Boston Aldermen have referred to a special committee the propriety of constructing an additional basin on the Sudbury system, of making improvements at Lake Cochituate, and constructing intercepting sewers.

Bridgeport, Conn.—As soon as the weather permits work will be begun on the works of the new water company. A commencement was made last year. Mr. James Staples is interested.

Greenville, O., water-works are completed. Water was turned on April 1.

Chattanooga, Tenn.—Mayor A. G. Sharp has issued a proclamation announcing that on April 21 a city election will be held on the question of raising of $500,000 for extending the sewerage system and for other improvements.

Jersey City Board of Finance has sent resolutions to the State Legislature opposing the passage of the water-works bill, which we recently quoted. The bill has failed to pass.

Portsmouth, Va.—On March 3, the water-works were bought by a syndicate composed of J. T. Pike, C. C. Hines, Cyrus W. Holmes, C. D. Ward, and Isaac Peck. Measures have already been taken for their extension and completion.

Lawrence, Kansas.—Contractors should watch developments here, for a project is now under way to increase the water-power by constructing a dam in the river, and cutting a conduit to convey the water to the city.

Frankfort, Ky.—The Mason, Gooch & Hoge Company has been chartered and will build railroads, bridges, water-works, etc.

Phœnix, R. I.—The Pawtuxet Valley Water Company has awarded the contract for the construction of the dam to Jacoby & Madden, of Bridgeport, Conn.

De Land, Fla.—Frederick S. Goodrich can give information about the proposed water-supply here, previously reported.

Pine Bluff, Ark.—The contract for building water-works here has been given to the Water, Light and Power Company, of St. Louis, Mo.

San Mateo, Cal.—The Manzanita Wate Company has begun operations on the great water-works enterprise for the supply of San Francisco and other cities, which we recently noticed. Senator Stanford is interested.

Manhattan, Kan., will have water-works. It has been voted to raise $50,000 for their construction.

San Francisco, Cal.—The Union Iron Works of this city has recently built a $25,000 pumping-engine for the Spring Valley Water-Works.

Sumter, S. C.—The water-works question is still under discussion here.

Vincennes, Ind.—Reports have been published from here of a prospect of water-works. We learn, under date of April 5, that "the citizens would not entertain any proposition for water-works, and those who were in favor of them have abandoned all hope of having any water-supply."

Cedar Rapids, Iowa.—Proposals are now out for the new sewerage work here. There will be about twelve miles of pipe sewers in District No. 1. The plans and specifications have been prepared by Chester B. Davis, C.E., of Chicago. For details see our Proposal Column.

Syracuse, N. Y.—On Monday, Mr. W. A. Sweet, of the Salmon River Water Company, presented on estimate of the cost of reservoir and pipe line to provide a daily supply of 12,000,000 or 13,000,000 gallons of water from the Salmon River. The storage reservoir is put at $284,082, the distributing reservoir at $170,240, the pipe line at $1,553,986; total, $2,008,308.

Water Company.—The Salmon River and Onondaga Water Company is a new organization chartered this week to supply Syracuse with water. A proposition has been made to Syracuse Council to furnish 12,000,000 gallons daily, the city to make a 20-year contract. The incorporators are Moses R. Crow, Edward F. Browning, Stanton D. Loring, Charles A. Rogers, J. Otis Wetherell, Elijah B. Phillips, Albert H. Gleason, William A. Haskell, Job E. Hedges, William M. Adler, Lemuel K. McKinney, and Morris G. Decker.

Chautauqua, N. Y., will have a water-supply. The Executive Committee of the trustees of the association has decided that water-works shall be built at once.

Milwaukee, Wis.—Water-mains will be laid in Clybourn Street from Twenty-ninth to Thirty-second Streets, and in Thirtieth Street from Clybourn Street to Fowler Street; also in North Avenue from Buffum Street to Hubbard Street, and in Eighth Avenue from Mitchell Street to Windlake Avenue.

Cleveland, O.—The construction of a new tunnel, by the Water-Works Board, a mile and a half long, will begin this season. It has been in contemplation for some time past. The tunnel will extend from the pumping-house to the crib, and perhaps a little further, and will cost, when completed, $280,000.

Morristown, N. J., will have water-works. Address Mr. Watkins at the Camden and Amboy Railroad office in Camden.

Holden, Mo., will have water-works, to be built by the J. B. Quigley Water-Works Company, of St. Louis.

Gallatin, Texas, will have water-works. Bonds to the amount of $40,000 have been issued.

Syracuse, N. Y.—On April 4, the newly-incorporated water company (the Salmon River and Onondaga Water Company) presented to Common Council notice of the incorporation, and a proposition to supply water. The company will erect works capable of furnishing 12,000,000 gallons of water daily, provided the city will agree to take 600 hydrants, at $50 per annum, and additional hydrants at same price.

Camden, N. J.—We learn that the sub-committee which is intrusted with the deciding upon the course to be pursued to obtain a water-supply, has not yet determined any definite policy.

Lowell, Mass.—The City Council has passed an ordinance authorizing the raising of a loan of $70,000 for sewers. W. T. McCarthy is City Clerk.

St. Augustine, Fla., wants sewers. An election is held this week on the question of raising $30,000 for the purpose.

Marblehead, Mass.—A correspondent writes: "The town is now moving in the matter of a water-supply. They have two propositions: (1) A supply within their own boundaries if possible. (2) A supply from the Salem Water Company. As the matter has not assumed shape in a definite form, it is impossible to tell what the outcome will be." Mr. S. C. Felton is the Town Clerk.

Middletown, Del., will have water-works at once. Surveys were made April 6. Professor R. Carnes, of the Rensselaer Polytechnic Institute is chief engineer, and A. C. Stiles is superintendent of construction.

GAS, STEAM, BUILDINGS, ETC.

Fremont, O.—The North-western Ohio Natural-Gas Company extended the mains to Fremont, O., and made a test illumination on March 19. It is intended to pipe the city, to supply gas for manufacturing purposes.

Incorporated is the New Jersey Electric Company. Capital $100,000.

Bellevue, O.—New gas-works will be built here. Plans have been prepared, and contractors are making estimates.

Mitchell, Dak., is putting in a new system of street-lighting.

South Bend, Ind., citizens have formed a company to sink gas-wells and furnish gas to manufactories. Mayor Longhman is a member of the company.

Birmingham, Ala.—On March 30 the City Council approved a scheme by which the city will take $250,000 of the new stock of the Gas Company, the Gas Company adding $50,000. The total capital of the company will then be $500,000, and extensions of works will be made. Gas is to be furnished at $1.50 to private consumers, and at $1 to the city,

McKEESPORT, PA.—A Pittsburg syndicate offers to locate a glass or iron plant here if the ground is donated and a loan of $30,000 secured by first mortgage on the works and payable in three years without interest.

MUNCIE, IND.—C. N. Wilcoxon, General Manager of Muncie Natural-Gas Company, is about to contract with a Pittsburg, Pa., firm for twenty-five miles of pipe and several thousand dollars worth of safety-fittings. His company has five large gas-wells, each having a pressure of 300 pounds.

PITTSBURG, PA.—On April 1 the Board of Health received only one bid for erecting two 30-ton garbage-furnaces, from the L. P. Rider Garbage-Furnace Company, which offered to erect one furnace for $3,000 and two for $5,000. The bid was taken into consideration.

CHICAGO.—The Edison Electric-Light Co. is permitted by ordinance to lay a conduit in certain streets, said conduit to be used exclusively for its own wires, and for no other purposes than for power, light, and heat. The company will not pass under sidewalks nor cross beneath lots without the consent of the abutting owners.

WORCESTER, MASS.—It is stated that a large building project is now well outlined. Horace H. Bigelow proposes to build a great building on the Rink lot, which will have thirty-two stores on the first floor, large numbers of offices above, and a hall capable of seating 4,000 persons. Norcross Bros., it is said, have already been engaged to build it, and the city will open and improve new streets bounding the lot on which it stands.

WAKEFIELD, MASS., has referred the question of lighting the streets with electric-lights to a special committee to investigate and report.

FOSTORIA, O.—This place has decided to bond itself for $35,000 to sink wells for gas to be given away free to manufacturing concerns.

GAS-HOLDER.—Bartlett Hayward & Co., of Baltimore, are erecting a 750,000-foot gas-holder for the Lowell Gas-Light Co. O. E. Cushing is the Engineer to the Gas-Light Co.

HARRISBURG, PA.—The contract for lighting the streets has been given to the Excelsior Electric-Light Company at $13,980 per annum.

ELGIN, ILL.—The State Senate and House Committee have reported in favor of appropriations amounting to $750,748 for the repair and enlargement of State asylums and hospitals.

ALEXANDRIA, VA.—A proposal has been made by the United Gas Improvement Company, of Philadelphia, to lease the city gas-works here, and pay 33 per cent. of the gross receipts to the city.

MINNEAPOLIS.—Incorporated is the Hennepin Avenue Theatre Company of Minneapolis. Incorporators: W. A. Barnes, Enoch W. Wiggins, Frank P. Weadons, Carroll E. Gates, Burt P. Gates, Minneapolis; Jacob E. Sackett, James M. Wood, Chicago.

PATERSON, N. J.—The Board of Education of the city of Paterson, N. J., intend to introduce heating and ventilation by steam, immediately, in new public schools, Nos. 14 and 15. The space to be heated in each will be about 140,000 cubic feet. Plans and proposals are desired.

MILWAUKEE.—The Legislature has authorized the city to issue $200,000 worth of bonds for the purpose of erecting a new city hall. Two hundred thousand dollars will be devoted to public parks in Milwaukee s corporate limits, and bonds to that amount will be issued.

BUILDING.—Colonel E. C. Ingersoll, of New York City, can give information about extensive building operations at Seven Mile Beach, between Cape May and Atlantic City. A syndicate of Philadelphia and New York capitalists will make great improvements here.

MONTREAL, CAN.—The Montreal Gas Company will erect a new gas-holder and retort-house, and place new 20-inch mains, at a cost of $200,000.

ORGANIZED is the Automatic Water Gas Company, of Nashville, Tenn., to build gas-works.

RAILROADS, BRIDGES, CANALS.

GREENEVILLE, MISS., on March 21, decided to hold a city election on the question of raising $50,000 for levees.

INCORPORATED is the Griffin, La Grange, and Birmingham, Ala., Railroad.

YOUNGSTOWN, O.—City Engineer Reno is making estimates for vitrified fire-clay brick-pavements, which will cost about $25,000. Proposals will be advertised within a few weeks.

RAILROAD.—Address Eugene Bremond, Austin, Tex., in regard to a railroad to connect with the St. Louis, Arkansas, and Texas Railroad.

BROOKLYN.—The Brooklyn Heights Railroad Company, to build a road in Montague Street, from the Wall Street Ferry to Court Street, has been organized by the election of the following officers: President, S. B. Chittenden, Jr.; Vice-President J. J. Pierrepont; Secretary, G. W. Chauncey, and Treasurer, M. Chauncey. The company was started as a cable-company, but it has been decided to use electricity as a motive power. The Nassau Cable Railway Company, which failed two or three years ago to get a franchise to build its road in some of the principal streets of Brooklyn, has renewed its application to the Board of Aldermen.

RAILROAD.—The Cincinnati and Birmingham Railroad has parties in the field surveying, and the road will be built as soon as possible. John C. Dougherty is secretary.

INCORPORATED in Illinois: The Toledo, Peoria, and Western Railroad Company, with the principal office in Peoria. William Hill, Warsaw, Ill., is a director.

RAILROAD.—The Louisville and Nashville and the Norfolk and Western Railroad Companies have agreed to unite in building an extension of lines in this county, Virginia. Engineers are making surveys.

ROANOKE, VA.—The Roanoke Street Railroad has been organized to build a street railroad here. Thomas Lewis is President.

BROOKLYN.—The Board of Assessors has decided to pave Bushwick Avenue with granite blocks. Cost, about $100,000.

RAILROAD.—The Pennsylvania Railroad Company wants proposals, until April 13, for grading and masonry for six miles of track on the Pittsburg Division. The office is 233 South Fourth Street, Philadelphia.

BRIDGE.—A bill has been introduced in the New York Legislature providing for a bridge across Great South Bay, from Podunk Point, in Southampton, to the beach.

SAN FRANCISCO, CAL.—Mr. Ashworth, Superintendent of Streets, asks the Board of Supervisors to appropriate $295,000 for work on streets and sewers the coming year.

LONG ISLAND CITY.—Benjamin Hantz, lowest bidder for macadamizing Jackson Avenue ($24,300), declines to take the contract, and the Supervisors of Queens County have awarded it to the next lowest, Garrett Furman, at $26,000.

RAILROAD.—A road will be built from East Wareham to Onset, Mass. W. F. Nye, of Onset, is a director.

CANALS.—The bill appropriating $550,000 to improving the Erie and Oswego canals in this State has become a law.

SALE OF RAILROAD.—The New York, Chicago and St. Louis Railroad will be sold according to order of the courts, and D. W. Caldwell has been appointed master commissioner to make the sale. No bid for less than $16,000,000 will be received.

CHICAGO.—The Chicago and Great Western Railroad Co. (inlet of Wisconsin Central) has accepted a city ordinance for building a viaduct over its tracks at Fifth avenue and Polk street, and for raising the Polk Street Bridge.

BOSTON.—City Engineer Wightman's plans for the bridge over the Charles River to Front Street, in Cambridge, are again a subject of discussion.

RAILROAD.—Incorporated is the Eufaula, Florida and St. Andrews Bay Air Line Railroad; also the Cincinnati, Huntsville and Birmingham Railroad Company.

BRIDGE.—The bill appropriating $25,000 for a bridge over Newtown Creek, at Maspeth, L. I., has passed both branches of the New York State Legislature and is in the Governor's hands.

RAILROAD.—Incorporated April 5, was the Alexandria and Texas Railway Company, of Alexandria, La. The building of the road will be begun immediately. Amos B. Watson and William M. Robinson, of Grand Rapids, and Franklin B. Head, of Chicago, are among the incorporators.

WATERTOWN, DAK.—The City Council has granted Charles Joscelyn a franchise to build and operate street railways in this city for twenty years. Mr. Joscelyn agrees to build a motor line between Watertown and Lake Kampeska within six months, and a street railway in the city within one year. The motor line will be four miles long.

ST. PAUL.—The Board of Public Works has reported favorably the plan of City Engineer Rundlett for the opening of Oak Street from Ramsey to Forbes Street, and grading of Louisa Street from Stryker Avenue to State Street, at an estimated cost of $12,958.

HELENA, MONT.—Contracts for tunnels and grades of the Montana Central Railroad, between Helena and Butte, have been let to Larson & Keefe, who also have the contract for trestling. It is expected that the line will be ready for rails in eighteen months. The main tunnel is a mile in length. Larson & Keefe are Helena, Mont., men.

MILWAUKEE.—The Chicago and North-Western Railroad Company will build a new bridge over their tracks at La Fayette Place, the plans for same having been agreed upon by the City Engineer and the Chief-Engineer of the company.

RED WING, MINN.—The Board of Trade and citizens in mass meeting have favored voting $50,000 in bonds to aid the Duluth, Red Wing and Southern Railroad; $25,000 to aid in building the bridge across the Mississippi at this point, and $25,000 to aid in construction between this city and Zumbrota.

CLEVELAND, O.—City Engineer Force has advertised for proposals for the construction of 8,250 lineal feet of iron hand-railing to be used on the Central Viaduct, also for paving several streets with brick and stone; also for the construction of sewers, and dredging.

ITHACA, N. Y.—Haines Bros. will build an electric railway here. The contract for motors has been given to the Safety Electric-Power Company. The road is known as the Ithaca Street Railway.

BIDS OPENED.

INDIANAPOLIS, IND.—C. J. Schultz, of Pittsburg, has the contract for the iron structure of the train sheds at Indianapolis. The skylights, tin roofing, cornices, etc., will be furnished by Thomas W. Irwin of Allegheny, Pa.

NEW YORK.—The bids for preparing and building a crib bulkhead from West Seventy-seventh Street to West Seventy-eighth Street, North River, which were to have been opened at the Department of Docks on Wednesday, March 30, and which were laid over on account of the absence of a quorum on that day, were opened on Friday, April 4, with the following result. The engineer's estimate of quantities was: About 17,000 cubic yards of dredging for the site of the crib bulkhead and in the slip in front of it and about 201,000 cubic feet of crib, complete, including fenders, moving posts and backing logs, etc. The following were the bidders:

O'Connell & Coffey, Brooklyn, $30,100; Joseph Walsh, New York, $24,250; James D. Leary, New York, $21,990; John Gillies, New York, $20,540; P. Sanford Ross, Jersey City, $21,143; Barth S. Cronin, Brooklyn, $21,165; Wm. P. Kelly, New York, $20,330.

The contract was awarded to Wm. P. Kelly.

AKRON, O.—Bids were opened March 25 by James Harrington, Chief Engineer of the Cleveland, Akron and Columbus Railway Company, for the iron bridging for the Dresden Branch, and contracts awarded as follows: Penn Bridge Company, bridges 4, 5 and 6, $21,600; Smith Bridge Company, all other bridges, $43,710; total, $65,310.

PITTSBURG, PA.—The contract for an elevator, with a lifting capacity of 1,500 pounds, has been awarded to Marshall Bros., of Pittsburg. The elevator will be placed in the City Hall. Bids for a second elevator are advertised for.

BOSTON.—L. M. Ham & Co. have been awarded the contract for supplying the wrought-iron floor construction for the new court-house, at $68,023.

BOSTON, MASS.—Proposals for furnishing the plumbing of the grammar-school house on Dudley Street were opened March 30. The bids were these: D. A. Horgan, $2,450; J. F. Cronin, $2,489; William Dwyer, $2,680; William Bramhall, $2,741; James Barrett, $2,279. The contract was awarded to James Barrett.

ST. PAUL.—The Board of Fire Commissioners has ordered architect Hand, of St. Paul, to prepare plans for the engine-houses at Merriam Park, and asked for estimates. The following bids were received for the construction of a new engine-house for Engine Company No. 1: Dolleny & Buse, $17,200; W. Johnson & Bro., $17,950; J. S. Rood, $17,295; G. H. Fletcher, $18,875; A. Bassford, $17,399; Henry Maltby, $17,392; B. Hadinger, $17,400; W. O. Herickson, $17,200; R. Sheire, $18,365; J. H. Donohue, $16,475; M. P. Ryan, $15,700; McSleny & White, $14,700; Doland Bros., $17,800; Nesbett & Co., for painting alone, $470. The bids were all laid over.

MILWAUKEE.—The Board of Public Works has awarded the contract for 1,900 square yards of cedar blocks for pavements to William Veetch at 52 cents per square yard.

BOSTON, MASS.—The Water-Board opened proposals for the mason-work of the Chestnut Hill pumping-station April 5. Bids were as follows:

BIDDERS.	Milford granite	Roxbury stone.
Holmes Bros	$53,032	....
R. R. Mayers & Co.	44,178	$43,178
Donahue Bros	42,990	38,990
T. Shea & Co. (without check)	54,757	....
Woodbury & Leighton (without check)	42,839	42,339
J. F. McCoy (late without check)	39,000	....

The last three bids were rejected for informality, and the contract was awarded to Donahue Bros.

GOVERNMENT WORK.

WASHINGTON, D. C.—Synopsis of bids, opened March 28 by Dr. F. M. Gunnel, Surgeon General, U. S. N., for ranges and cooking utensils: George W. Hartman, $498; Robert E. Henderson, $475; W. H. Harrison & Bro., $473; Shock & Kryder, $570.75; W. B. Dixey, $437; Charles Williams' Sons, $445. All the bidders were from Philadelphia. Contract awarded to W. B. Dixey on his bid of $437.

WASHINGTON, D. C.—Abstract of bids for constructing two school-houses opened by the Engineer Commissioner of the District of Columbia: F. Baldwin, school corner of 8th and C Streets, $22,800; school on M Street between 6th and 7th Streets, $22,500; total, $45,300. J. L. Parsons, $22,672 and $22,693; total, $45,365. C. Thomas, $22,750 and $22,400; total, $45,150. D. A. Driscoll, $22,812 and $22,486; total, $45,298. The contract was awarded to F. Baldwin.

WASHINGTON, D. C.—Bids were opened by General M. C. Meigs for handrails for stairs of the new Pension Building, also for brackets and rosettes. Bids for the whole were as follows: L. H. Schneider's Son & Co., Washington, $1,068.90 and $1,129.26; Manly & Cooper Manufacturing Co., Philadelphia, $1.10 per foot; J. E. Bolles, Detroit, $1,134.60; Manly & Cooper Manufacturing Co., for all, $649, $763, $1,230; Standard Wood-Turning Co., Jersey City, $764, $851, $903.20; H. C. Hinternesch & Son, Baltimore, $1,583, $1,247, $1,183; Hecla Iron Works, Brooklyn, $1,800.

HAMILTON, MO.—Synopsis of bids for iron roof work of post office, etc., opened by the Treasury Department, April 4: Bouton Foundry Co., Chicago, Ill., $6,214; Motherwel Iron & Steel Co., Logan, O., $8,948; Haugh Ketchum & Co. Iron-Works, Indianapolis Ind., $6,859; Snead & Co. Iron-Works, Louisville, Ky., $8,076.

LYNCHBURG, VA.—Synopsis of bids for iron furring and lathing for court house and post office opened March 31 by the Treasury Department:

BIDDERS.	Amount of Bid.	Additional work. Rate per ft
John Cooper, Mount Vernon, O.	$957	18c.
Haugh, Ketchum & Co. Iron-Works, Indianapolis, Ind	1,492	20
Knisely & Miller, Chicago, Ill	1,960	30

LIGHTHOUSES.— Contractors interested in lighthouses should note that the Lighthouse Board has now in hand plans for several lighthouses to be erected at once on the New England coast. Among these is the lighthouse at Deer Island, Boston, for which $35,000 is appropriated.

BROOKLYN.—New dry docks will be built at the Navy Yard here, as well as at Norfolk, Va. The appropriation is $1,000,000.

WASHINGTON.—The contract for the construction of seven elevators in the State, War, and Navy Department building, has been awarded to the Crane Elevator Company of Chicago, at their bid of $17,190.

SECRETARY WHITNEY will receive proposals until August 1 for constructing the cruiser "Newark," cruisers 5 and 6, and two gunboats.

NEW YORK.—Bids were open at the Army Building by Walter McFarland, Lieutenant-Colonel of Engineers, on Wednesday April 6, for improving Newtown Creek, by dredging, and resulted as follows: According to the engineer's estimate there is required about 70,000 cubic yards of dredging above Maspeth Avenue, and about 60,000 cubic yards of dredging below Maspeth Avenue.

Bidders.—Atlas Dredging Company, Wilmington, Del., per cubic yard, below Maspeth Avenue, 49 7/10 cents, above 39 7/10 cents, total, $58,610; Morris & Cummings Dredging Company, New York City, per cubic yard, below Maspeth Avenue, 48 cents, above Maspeth Avenue, 35 cents, total, $54,600; Thomas Potter, Jersey City, N. J., only bid on the work above Maspeth Avenue. His figure was 33 1/3 cents per cubic yard, total, $20,000.

WASHINGTON, D. C.—Abstract of proposals for furnishing and putting in place thirty-three skylights over record rooms of fire-proof building for Pension Office, Washington, D. C., opened by General M. C. Meigs, Supervising Engineer and Architect, Monday, April 4:

James S. Parsons, Washington, D. C., $2,800, 60 days; William Rothwell, Washington, D. C., $2,694, 90 days; Robert R. Taylor, Washington, D. C., $2,376; James White, Brooklyn, $2,071, with damper, $2,096, six weeks; O. L. Walpteiner, Washington, D.C., $2,037, with damper, $2,400, 60 days; White & Overman, Washington, D. C., $1,914, 60 days; Morgan, Thomas & Co., $1,697.50, six to eight weeks; Vail & Young, Baltimore, Md., $1,896.50; Edward Kirk, Chicago, $1,865; John Seaton, Brooklyn, $2,420; Joseph Plenty, New York, $2,150 galvanized iron, $2,800 copper; A. E. Rendell, New York, $2,516.30; Mesker & Bro., St. Louis, $1,992; J. K. Cramer, Washington, D. C., $1,894, six weeks; George Hayes & Co., New New York, $1,251.45. The bid of Hayes & Co. was accepted.

PENSACOLA, FLA.—Synopsis of bids for approaches to the Court-House, Post-Office, etc., opened by the Treasury Department, April 2:

	Excavating, Grading, Soiling, Sodding, Stone-work, Granite Paving and Macadam Driveway.	Exterior Sidewalks, and Approaches to Front Steps.
S. S. Leonard, Pensacola.......	$2,290.66	$1,413.26
Dumesneil Bros., Louisville, Ky....	4,500.00	1,500.00
A. V. Chubbs, Pensacola.........	3,444.75	705.25
McCarthy & Corbett, Washington, D. C..	4,500.00	1,348.00

SAN FRANCISCO, CAL.—Bids for dredging Redwood Slough were opened March 30, 1887, by Colonel G. H. Mendell, U. S. Engineers. One bid was received from M. J. Madison, at 24 cents per cubic yard.

MISCELLANEOUS.

TRENTON, N. J.—On March 31 the State Senate passed the bill appropriating $125,000 for a Soldiers' Home in Kearney township, Hudson County.

CHINESE RAILROAD.—It is reported from London that a syndicate of Belgian and English financiers have offered the Chinese government a loan of £32,000,000, repayable in ten years, for the construction of 1,500 miles of railroad, partly from Nanking to Pekin and partly from Canton.

LOS ANGELES, CAL.—A company is organized here to erect works and machinery for the manufacture of asphalt paving materials. Captain A. W. Barrett is interested. The capital is $100,000.

DETROIT, MICH.—The Frontier Iron Works have just received the contract for building the engines for the new steamer to be built at Wheeler's shipyard, West Bay City, Mich.

MESSRS. LACOSTE & CO. have applied to the Legislature for an act incorporating a company which will be authorized to run by means of steam, electricity or otherwise, a system of railways through the city of Montreal, or any part of the island. The intention is to build a a railway around the island of Montreal, having numerous stations at points suitable for summer resorts; thus giving access to many country places which up to the present could not be enjoyed. The company intend also to run an elevated railway to the top of the mountain. It is proposed to have two routes, by Bleury and by McTavish Streets. The project has met with great favor among business men and many have already promised their support. The capital will be a million. The signers of the petition are Messrs. F. W. Henshaw, Robert Cowans, and Henry Dobell. According to the act of incorporation sought for, the company will require the assent of the municipalities through which the railway will pass before they can begin operations.—*Montreal Star, March* 14.

SATURDAY while boring for gas at Fort Scott, Kansas, they struck a flowing well of water which rushes out at the rate of 3,000 barrels per day. A vein of fine lead ore was also discovered.—*Exchange of April* 2.

THE Pennsylvania Steel Company will erect steel works at Sparrow's Point, on Chesapeake Bay, nine miles from Baltimore. The company is at present located at Steelton, Pa.

PUBLICATIONS RECEIVED.

FIRST AND SECOND ANNUAL REPORTS OF THE SEWER COMMISSIONERS OF THE CITY OF PAWTUCKET for the years ending 1885, 1886. 2 pamphlets.

COVENTRY URBAN SANITARY DISTRICT. Twelfth Annual Report of the Medical Officer of Health. 1886. Pamphlet, 19 pp.

ANNUAL REPORTS OF THE CITY ENGINEER OF THE CITY OF CHELSEA for the years 1885, 1886. William E. McClintock, City Engineer.

TWENTIETH REPORT OF THE BOARD OF WATER COMMISSIONERS OF THE CITY OF WATERBURY, CONN., for the year ending December 31, 1886. Welton & Bonnett, Engineers.

REPORT OF THE SPECIAL COMMITTEE on the Disinfection of Rags. American Public Health Association, 1886.

EIGHTEENTH ANNUAL REPORT OF THE BOARD OF HEALTH OF THE TAXING DISTRICT OF SHELBY COUNTY, TENN. (City of Memphis), for the year 1886. By G. B. Thorton, M. D., President.

CITY OF LIVERPOOL, PORT SANITARY AUTHORITY. Report of the Medical Officer of Health, 1886.

THE VESTRY OF THE PARISH OF FULHAM. Third Quarterly Report of the Medical Officer of Health, Waltham Green, London, S. W.

SCHOOL HYGIENE: The Laws of Health in relation to School Life. By Arthur Newsholme, M. D. London: Swan, Sonnenschein, Lowrey & Co. 12mo, cloth, 140 pp.

AMONG THE ARCHITECTS.

New York City—Several dwellings on West 92d street, on the site adjoining the Methodist Episcopal Home, for Mr. J. W. Stevens of New York; the buildings will be of brick and stone and will front seventy-one feet on 92d street; Mr. Aneurin Jones is the architect.

New York City—Mr. John Prague is preparing plans for several dwellings for Mr. D. Willis James, some of which will be erected on the south side of 86th street, 185 feet west of 9th avenue and others on the same street, 350 feet west of 9th avenue; the buildings will be 20x56 and 21x56 and the exterior will be of brick and terra cotta; each dwelling will have a large extension; the cost will be $25,000 each.

New York City.—Plans for nine houses are being prepared by Edward L. Angell for Mr. Edward L. Noble, of this city; the buildings will be located on the west side of Eighth Avenue, overlooking Central Park, and will occupy the entire block from Eighty-fourth to Eighty-fifth Streets; the Romanesque style of architecture characterizes the exterior; the buildings will be four stories high, with basement; fine-cut brown-stown, with molded cornices and bay-windows, will be the exterior features; the interiors will be finished in hard wood.

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house· *ten*, tenement; *e*, each *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK CITY.

347 E 87th st, 5-story br and stone ten; cost, $14,000; o. G A Schellenger.

323-25 114th st, 2 5-story br tens; cost, each $18,000; o, and b, John Van Dosen; a, G B Pelham.

9 E 85th st, 4-story br dwell; cost, $18,000; o, F J Schnugg; a, Julius Castner.

8th av, w s, extends from 84th to 85th st, 9 4-story and basement br and b s dwells; cost, $27,000 each; o, William Noble; a, E L Angell.

122d st, n s, 225 w 7th av, 2 4-story brick dwells; cost, $9,000; o, Margaret Sturgeon and Margaret Sinclair; a, George B Pelham.

8th av, n w cor 126th st, 5-story br and b s tens; cost, $35,000; o, J C Burne; c, day's work.

126th st, n s, 100 w 8th av, 2 5-story br tens; cost, $22,000; o, W H Wagner; o, etc., same as last.

147th st, s s, 100 e 8th av, 5-story br and b s ten; cost, $22,500; o, J F Dunker; a, Christian Allen; b, not selected.

162d st, n s, 125 e 10th av, 3 2-story and basement fr dwell; o, William Thompson, a and c, William H Berrian.

126th st, s s, 100 e 3d av, 12 5-story br and marble tens; cost, $18,000 each; o; Frederick Rohrs; a, James Barrett.

7th st, n s, 97.10 w 6th av, 8 2-story br and b s dwell; cost, $5,000 each; o, George Keymer.

662 W 56th st, 200 ft w of 5th av, br dwell; cost, $80,000; o, Charles A Stain; a, Thomas W Goodwin.

N s 86th st, 210 ft w of 9th av, 6 dwells; cost, $130,000 all; o and a, John G Prague.

S s 86th st, 105 ft w of 9th av, 4 br dwell; cost, $88,000 all; o, Pat Kennedy and T J Dunn; a, John G Prague.

S s 100th st, beginning 100 ft e of 3d av, running west, 9 flats; cost, $130,000 all; o, Leonard Beckman; a, George Walgrove.

W s 4th av. 50 s 110th st, 2 brick flats and stores; cost, $60,000; o, Robert J M Gin; a, Andrew Spence.

S s 111th st, 80 w 3d av, brick dwell; cost, $13,000; o, James Wood; a, Andrew Spence.

67 Gansevoort st, br ten and store; cost, $10,000; o, Bernard Hughes; a, B J Schmelzer.

Park Row, cor Chambers and Duane sts, br office bldg and store; cost, $35,000; o, Henry Bischoff; a, Fred Ebeling.

385 6th av, br store; cost, $16,000; o, Michael Weckely; a, Jordan & Siller.

103 Bedford av, br flat; cost, $15,000; o, Adolph Schreetmuller; a, Jordan & Siller.

61-63 Mott st, 2 br flats and stores; cost, $21,000 all; o, Barney Isaacs; a, Schneider & Herter.

S s 71st st, 320 w 8th av, 3 br dwells; cost, $54,000 all; o, H Lamb, and J F Andrews; a, Lamb & Rich.

N e 7th av and 125th st, 6 br ten and stores; cost, $75,000 all; o, W A Wilson; a, D & J Jardine.

N s 102d st, 100 e 10th av, 4 br flats; cost, $76,000 all; o, Joseph Lawson and Francis W Jenks; a, Jos H Taft.

209-211 Sullivan st, br flat; cost, $30,000; o, Sam McCreery; a, J Kastner.

121st st n s, 122d st s s, 175 w 7th av, 8 br dwells; cost, $110,000 all; o, Ed Y Gallon; a, Geo W Walgrove.

S s 106th st, 285 w 1st avenue, br flat; cost, $12,000; o, Chas McCloskey; a, J F Burrows.

S e cor Broome and Cannon st, br flat; cost, $22,000; o, A S Kalischer; a, Fred Ebeling.

49 Eldridge st, br flat; cost, $23,000; o, M Baum; a, Herter Bros.

58 Warren st, br warehouse; cost, $18,000; o, Jas R Breevoort; a, J B Snook & Sons.

N s Gansevoort st, w 9th av, brick storage house; cost, $35,000; o, R Goelet; a, Jos M Dunn.

429-431 W 28th st, 2 br flats; cost, $40,000 all; o, M A Stafford; a, Henry Davidson.

N s 22d st, 100 e Madison av, brick dwell; cost, $20,000; o, Henry Riehl; a, H Davidson.

N s 64th, 410 w Ninth av, 7 br dwells; cost, $84,000 all; o, C H Bliss; a, E L Augell.

14-16 W 125th, br flat; cost, $35,000; o, J Bach; a, J Hoffman.

S s 117th, 200 e Third av, br flat; cost, $12,000; o, J Kavanagh; a, Andrew Spence.

916 Second av, br flat and store; cost, $18,000; o, Max S Keon; a, A J Finkle.

504 E 118th, br ten; cost, $10,000; o, Henry Kroos; a, B Walther.

S s 70th, 354 w West End Av, 7 br stables; cost, $70,000 all; o, H Van Wagner and others; a, Lamb & Rich.

W s Mangin, 55 s Stanton, 3 br tens; cost, $40,000 all; o, J M Schmitt; a, Ed Wenz.

E s 7th av, bet 136th and 137th, 6 br dwells; cost, $250,000 all; o, Oscar and Malvine Hammerstine; a, Andrew Spence.

69 Eldridge, br ten; cost, $14,500; o, Raphael Kuschewsky; a, Fred Ebeling.

N e cor Baxter and Franklin, br flat; cost, $22,000; o, Jacob Cohen; a, as above.

S s 70th, 200 w West End av, 3 br dwells; cost, $30,000 all; o, Hubert Wagner and others; a, Lamb & Rich.

S s 100th, 100 w Third av, 9 br flats; cost, $135,000 all; o, Leonard Brackman; a, Geo M Walgrove.

60-62 Warren, br store; cost, $40,000; o, Thos Morrell; a, John B Smith.

S s 120th, 350 w Sixth av, 7 br dwells; cost, $85,000 all; o, Geo H McEntee; a, Andrew Spence.

N w cor Old Broadway and 130th, 4 br flats and stores; cost, $80,000; o, Oltinger & Bro; a, Geo Matthias.

48-50 Leroy, 2 br flats; cost, $36,000 all; o and a, as above.

453 West 27th, br flat; cost, $20,000 all; o, Henry Reihl; a, Henry Davidson.

S s 45th, 62 e First av, br stable; cost, $30,000; o, Schwartzchild & Salzberg; a, A B Ogden & Son.

S s 19th, 170 w 8th av, 2 br flats; cost, $40,000 all; o, J B Gillie; a, M V B Ferdon.

45 Morton, br flats, cost, $22,000; o, David Strauss; a, Wm Schickel & Co.

N w cor 129th and Boulevard, br store, dwell and stable; cost, $12,000; o, Wm Farrell; a, Wm H Walker.

28-36 Liberty, office bldg; cost, $375,000; o, F J Stone; a, E D Lindsey.

S w cor 9th av and 52d, br ten; cost, $20,000; o, J B Gillie; a, M V B Ferndon.

109-121 E 45th and 456-464 Lexington av, 12 br dwells; cost, $200,000 all; o, Charles Graham & Sons; a, Powers.

ALTERATIONS, NEW YORK.

242-244 E 39th st, br flat; cost, $12,000; o, Christian S Wyhie; a, Belland.

253 W 42d st, Home for Old Women; cost, $70,000; o, Clinton Apartment Co; a, Ernest Flagg.

878 Sixth av, br store and lofts; cost, $10,000; o, J G Johnson; a, W P Wentworth.

BROOKLYN.

Pacific st, s s, 100 e Vanderbilt av, 3-story and attic convent; cost, $18,000; o, Rev. Edward Corcoran; a, T F Houghton.

Broadway, w s, 36 s Sumpter st, 2 4-story fr stores and ten; cost, $5,000; o, a, and b, Henry Vollweiler.

Gwinnett st, 163-165, n s 234 w Throop av, 2 3-story fr tens; cost, $8,000; o, and b, E Schneider, a, T Engelhardt.

411 Graham av, w s, 25 s Withers st, 3-story fr dwell; cost, $5,600; o, Morris Blau, 407 Graham av; a, T Engelhardt; b, Sammis & Bedford and Doyle & Brazill.

S w cor Brodway and Hart st, br dwell; cost, $12,000; o, F. Herr; a, John Herr.

N s Monroe st, 50 ft e of Patchen av, 6 br dwells; cost $27,000 all; o, Andrew Peck; a, E F Gaylor.

N s Garfield Place, 228 ft w of 6th av, 4 br dwells; cost, $18,000 all; o, Ed H Mowbry; a, not selected.

S s Jefferson av, 255 e Tompkins, 6 br dwells; cost, $48,000 all; o, Colson & Reiners; a, W H Colson.

W s Alabama av, 150 n Eastern Parkway, 3 fr dwells; cost, $13,200 all; o, Francis W Mulroy; a, A R Ketcham.

Magnolia, 25 w Evergreen av, br dwell and store; cost, $7,500; o, Chris Reuther; a, Jos T Miller & Son.

(Continued on page 495.)

BUILDING INTELLIGENCE.

(Continued from page 494.)

S s 55th, 200 w Second av, 3 fr dwells; cost, $7,000; o, John F Taudy; a, J Queensbury.

N w cor Nostrand and Gates av, br bldg, store, hall, and lodge room; cost, $25,000; o, Geo Boernman; a, Geo P Cloppeel.

S e Greeno av, 100 s w Evergreen av, 3 fr tens; cost, $13,000 all; o, John Menchan; a, Fred Weber.

S s Quincey, 125 w Lewis av, 4 br tens; cost, $32,000 all; o, L P McGarry; a, John McGarry.

W s Marcy av, 20 s Lexington av, 2 br tens; cost, $14,000; o, E E Nelson; a, J G Gloren.

S w cor Marcy and Lexington avs, br ten; cost, $7,000; a and o, as above.

S s Penn, 100 e Lee av, br dwell; cost, $9,500; o, John M Ranken; a, E F Gaylor.

N s Halsey, 50 n Lewis av, 4 br dwells; cost, $20,000 all; o, Ph W Maguire; a, J J Reynolds.

N s Fulton, 160 w Rockaway av, 7 br stores and dwells; cost, $35,000 all; o, Geo R Brown.

MISCELLANEOUS.

ATHOL, MASS.—Address F. W. Breed, of Lyon, about a shoe-shop to be built here.

ALLEGHENY, PA.—Beech st, 2-story and attic br dwell; cost, $10,000; o, Wm Beggs a, Jos Anglin; b, Cochran & Davis.

ARGENTA, ARK.—Two two-story brick veneered stores; cost, $4,000; o, L W Cherry; a, F J Ricken; b, not let.

ALBANY.—Floeser & Son are the contractors on St. Peter's German Evangelical Lutheran Church on Bedford Avenue. The architect is Ernest Hoffman, Jr., of Albany. Work will be pushed.

ALBANY.—South Pearl, cor Norton, br and stone business block; cost, $35,000; o, A V Benson; a, Fuller & Wheeler; b, Pasquini & Stevens.

AUGUSTA, GEO.—In progress is the new hotel on the site of the old Globe. The work is done by Contractor Sandford.

BESSEMER, ALA.—A $25,000 hotel will be built here by Mr Berney, of the Berney National Bank.

BALTIMORE, MD.—In progress are two 4-story bldgs on Hanover, near Pratt Street. Geo H Callis is builder; Newbold & Sons are the owners.

BROOKLYN.—A fire-engine house will be built on Elm street near Central Avenue. Commissioner Conner will receive bids until April 14.

BOSTON, MASS.—The United Hospital and Dispensary will build a new hospital. President Oscar E Doolittle may be addressed.

BALTIMORE, MD.—Baltimore and Howard, 9-story br and stone warehouse; o, Darby & Co; a, C L Carson; b, Israel Griffith.

Howard and Stockholm, 3-story br dwell; o, C P Hastings.

N Bond, 10-story br dwell; o, C Kroezer.

Howard and Pratt, 4-story br and stone warehouse; cost, $12,000; o, Sharp & Dohme; b, G P Hopkins.

Fayette and Aisquith, College of Pharmacy; cost, $30,000; a, F E Davis & Bro; b, G P Hopkins.

The Second Universalist Church intends to build on Lanoale and Guilford Avenues. Plans are being drawn.

BOSTON.—The Chamber of Commerce has finally decided to build a large structure on the square bounded by Indian, Broad, Central and State Streets. The cost with the site will be about $1,000,000.

BARTON, FLA., will have an $18,000 school-house.

BOSTON.—Preliminary plans of the Athletic Club have been drawn. The building will be erected on Dartmouth Street. Address Arthur Hunniwell, 81 Milk Street.

BOSTON, MASS.—Rogers av, br engine house; cost, $30,000; o, Boston and Providence R R Co.

246 Beacon, br dwell; cost, $35,000; o, Mary E West; b, G L Eldridge.

CONCORDIA, KAN.—W R Parsons' Sons, of Topeka, are architects of the court-house here.

BUILDING INTELLIGENCE.

CHICAGO, ILL.—684-86, W. Chicago av, br store and dwell; cost, $10,000: o, G. C. Johnson.

883 S Wood, br dwell; cost; $10,500; o, Frank Paul.

39-41 Laflin, br dwell; cost, $12,000; o, William Pottle; a, Edbrooke & Burnham.

93-101 Clark, 3-story addition; cost, $30,000; o, estate of C H McCormick; a, A. M Colton.

2916-22 Archer av, br store and flats; cost, $35,000; o, Reilly & Healy; a, Furst & Rudolph.

N. Robey, n of North av, br cottage; cost, $10,000; o, J Oparka.

364-66 W. Ohio br dwell; cost, $16,000; o, C. Buckingham; a, W M Adams.

301 E Huron, br dwell; cost, $14,000; o, T W Crosby; a, Bailer & Hill.

275 Wells, br store and flats; cost, $16,000; o, J L Ale; a, Schaus & Berlin.

84-86 Randolph br addition; cost, $16,000; o, J S Price.

428-34 Elm, br flats; cost, $35,000; o, Potter Palmer; a, C M Palmer.

Cor Harrigan and Sherman, appraisers' warehouse; cost, $25,000; o, supervising architect Bell; a, the Government.

S ecor Dearborn and Randolph, additional store remodeling; cost, $25,000; o, L J McCormick; a, Burnham & Root.

CARTHAGE, MO. — Carthage Collegiate Institute will be built here. Contract for masonry let. J. L. Moore is Chairman of the committee.

State street, improvements to Nat. Com. Bank building; cost, $57,000; a, R. W. Gibson; b, John Snaith.

CLEVELAND, O.—Mr. A. D. Kent, architect, has prepared plans for the Power block, to cost about $42,000. It will be heated by steam and have hydraulic elevators.

The same architect has prepared plans for an office building and car barn for the Newburgh and Broadway Street Car Company, to cost $25,000.

DECATUR, ALA.—The Oak Extract Company will build large works here.

DENVER, COLO.—The St. James Hotel Company will expend a large sum in alterations of the hotel. Address Mr. C. B. Kountze.

DETROIT, MICH.—The Detroit Opera House will be remodeled during the summer after plans prepared by Irving K. Pond, of New York.

91 Bagley av, br store; cost, $12,800; o, A E Bigelow; a, H Chandler.

600 Second av, br dwell; cost, $13,500; o, E Neppenan; a, W Scott & Co; b, E Neppenan.

Cass av, br store; cost, $10,000; o, W H Prittie; a, A E French; b, A F Holmes.

282 Fourth st, br dwell; cost, $10,000; o, P J Sheahan; a, W A Malcomson; b, Bunting & Sigman.

FALLSTON, MD.—Catholic Church; cost, $2,500; a, T C Kennedy.

GREAT BARRINGTON, MASS.—A hall in memory of Rev. Orville Dewey will be built here by the Sheffield Friendly Union.

GROTON, DAK.—A flouring mill is to be built with a capacity of 500 barrels per day. The incorporators are L H Neff, S J Griffin, H Bibbins, S B Rowe and John Cole. Work will be commenced on it at once.

HELENA, MONT.—Charles Lehman will build a brick building on Bridge and West Main sts, to cost $10,000. Ernest Hahn has the masonry contract.

JAMAICA, L. I.—The Long Island Railway Company will build an $80,000 station and engine-house here.

KANSAS CITY.—Eleventh st, cor Washington, 2-story br dwell; cost, $15,000; o, V B Bell.

Ninth st cor Olive, 2-story br dwell; cost, $15,000; o, M S Tyler.

LOUISVILLE, KY.—Highland Presbyterian Church will build, beginning work at once. It will cost $12,000. The architect is C S Murgell.

BUILDING INTELLIGENCE.

MILWAUKEE.—J Mairose will build a $25,000 3-story br block for stores and offices on the West side of Reed Street, between Oregon and Florida Streets.

G Pfister will build a large hotel on Jefferson Street.

Mr Emil Schandein, Vice President of the Philip Best Brewing Co, will erect a br and stone dwell on Grand Avenue, between 24th and 25th Streets. The cost of the building will be $130,000.

Thomas Greenwood is having plans prepared for a new business block in the village of Wauwatosa, Milwaukee's western suburb. The building will contain two stores and a public hall and will be three stories high. It will be built of brick and cost about $12,000. Address Thomas Greenwood, Wauwatosa, Wis.

Leo Roth's house will cost $10,000 instead of $6,000, as reported in No. 17, Vol. 15, of "The Sanitary Engineer and Construction Record." Hambold & Froeming are the contractors.

C Schucknecht will construct the $23,000 br dwell on Prospect Avenue for George H Heinemann; H C Koch & Co., architects.

Permits were issued for seven new buildings from $2,000 to $6,000 in value this week, March 28 to April 4.

H C Koch & Co are preparing plans for a 60x125 wagon factory for G W Ogden & Co. It will be a 4-story br bldg on Third Street, between Wells Street and Grand Avenue, and will cost $24,000.

H C Koch & Co are also preparing plans for a summer residence to be erected by H G Rogers at Okauchee Lake; for a $30,000 hotel at Monroe, Wis; and for repair shops to cost $50,000 at Antigo, Wis., to be built for the Milwaukee, Lake Shore and Western Railway. The main building will be 265 by 80 feet and the other buildings will be 80x185 feet and 64x30 feet respectively.

MILWAUKEE.—Jacob Bolt has the contract to build the new school for the St. Michael's Society, that will cost $12,000, and will be built on Twenty-fourth Street.

MINNEAPOLIS.—It is now well understood that the Fond du Lac Thresher Company will bring its plant here, locating at the suburb Junction City. A large amount of the capital stock has been subscribed. The Rigby Car-Wheel Company, of Chicago, will also soon put in its plant in the same location. Mr. Rigby is also organizing a company to manufacture nails. It is also proposed to put in a rolling-mill.

MURPHYVILLE, Brewster County, Tex., will have a new court-house, to cost $15,000. The contract will be awarded May 9 by T. C. Brockenbrow, County Judge.

MONTREAL, CAN.—St Jean Baptiste Church will have a new building 100x70 feet, after plans by Mr. Roy, architect.

NEW HAVEN, CONN.—Mr. J Cleveland Cody, of New York, will be the architect of the library building for which Mr. S. B. Chittenden, of Brooklyn, donates the money. The cost will be $100,000.

NATCHEZ, MISS.—A hotel will be built here by the Natchez Hotel Company.

OAKLAND, CAL.—Messrs. Goodrich & Newton have under way the following buildings:

New wooden mill, to cost $150,000; this city.

Brick 3-story factory; cost, $20,000; this city.

New 3-story business block at Napa City, Cal.; to cost $12,000.

Two residences at Piedmont, Cal; cost, $15,000 and $17,000 each.

New hotel at Crescent City, Cal; cost $55,000.

Work here, it is reported, will be brisk this season and times are very propitious.

PHILADELPHIA.—Howard Hospital and Infirmary for Incurables will have a new building on Broad and Catharine sts. Wm. P. Cresson, of the Board of Managers may be addressed.

2d, bet Morris and Moore, 3 stores and dwells; b, Dunbar & Myers.

BUILDING INTELLGENCE.

S w cor 8th and Market, 5-story br store; b, Wm Fogg.

605 S 6th st, 3-story store and dwell; o, John Mellen.

Moyer, bet Palmer and Hanover, 5 2-story dwells; b, Jas McCauley.

39th and Parish, 4 2-story dwells; o, Wm J Shedwick.

Leverine, bet Main and Mower, 2 dwells; b, Jas Rinker.

13th and Vine, 4-story bldg; b, Reit & Riley.

3d, bet Cambria and Indiana, 8 dwells; b, H W Bower & Son.

Ogle below Fountain, 4 2-story dwells; o, Peter Furguson.

Hamilton and 38th, 3-story dwell; b F H Tweed.

Carlisle, bet York and Cumberland, 4 dwells; o, Jos N Pattison.

PROVIDENCE, R. I.—Broad and Lawrence, fr dwell; o, J B Mason; a, Stone, Carpenter and Wilson; b, not yet let.

ROCHESTER, N. Y.—A school-house will be built in District No. 2, Irondequoit, after plans by Orlando K. Foote, architect, 62 Osborn House block.

RUXTON, N. C.—R R 6 fr dwells; cost, $25,000; o, Wm A Fisher & Bro; a, Wyatt & Sperry; b, L C McCusker.

RACINE.—A large hotel will be built here.

SPRINGFIELD, MASS.—The Managers of the Boston and Albany Railroad will build a depot here. The plans are from the office of the late H H Richardson, of Boston.

SALEM, MASS.—St. James Parish will build a new church.

ST. PAUL.—A new opera house is to be erected before September, to cost $100,000. J E Sackett and J H Wood are interested. The building will be fire-proof.

A new Methodist church is to be built in St. Albans Street, to cost $10,000 or upwards. Rev S G Smith, James Suydam, G N Hillman, and E P Penniman are the committee in charge.

8th, near Wakonta, addition to boarding stable; cost, $7,000; o, R Martin.

Summit av, near Silby, br veneered fr dwell; cost, $8,000; o, A Oppenheim.

Portland, near Dale, 3 2-story br dwells; cost, $5,000 each; o, Wallingford & Norcott.

Western, near Silby, 3-story br store and dwell; cost, $8,000; o, N R Frost.

Concord, near State, 2-story br block, srores, and dwell; cost, $20,000; o, W Berlandi.

W Canada, near 13th, 3-story br block, stores, and dwell; cost, $17,000; o, P Schileman.

WEBSTER, N. C.—Elliott & Elliott are contaaclors for a court-house here, to cost $11,400.

WALLA-WALLA, W. T.—Henderson & Jones are contractors for brick buildings to be erected for Dr. Holmes, and Messrs. Ennis & Betts.

WORCESTER, MASS.—Main, cor Wellington, br and stone church; cost, $100,000; o, Old South Cong Society; a, not decided.

WINCHESTER, MASS., will expend $10,000 in additions to the town library building.

WATERTOWN, DAK.—A capitalist from Denver, named Starr, will at once build a three-story commercial brick building having 100-feet front and 150 feet depth on Maple Street. A large club house is to be erected on the shore of Lake Kampeska early this season.

(Continued on page 496.)

BUILDING INTELLIGENCE.

(Continued from page 495)

PHILADELPHIA.—Sharp and Adams, 5 3-story dwells; b, Thos Hagerty.

29th, bet Dauphin and Herman, 5 dwells; o, Adolph Kreutzer.

Cambria and Hope, 3-story store and 3-story dwell; b, J M Buchanan & Bro.

Thompson, bet Buckins and Lefever; 2 dwells; o, Amos W Linn.

27th, bet Oxford and Columbia av, 4 2-story dwells; b, Thos T Smith.

Decorations.

THE TENTH VOLUME

OF

The Sanitary Engineer

Includes the twenty-six weekly issues from June 5 to November 27, 1884.

Among the articles of permanent and special interest may be mentioned:

Notable Exhibits at the International Health Exhibition, London. These illustrated descriptions were prepared by specialists, and possess more than usual interest, included in which are illustrations of notable lead-work, of special interest to plumbers; description of Clark's process for softening and purifying water; also illustrations and descriptions of various sewage and water filters; illustrated description of steam ovens; a history and elaborate description of the various methods of separating cream by mechanical means, and a description of refrigerating machines.

London Water Companies. Elaborate description, extending through several numbers, of the interesting exhibits of the London Water Companies, showing section of their filter-beds, and numerous interesting details to water engineers. These papers were prepared by a well-known borough engineer, and are interesting to hydraulic engineers.

Illustrated Description of the Plumbing, Heating, Lighting, and Ventilating of Notable Buildings. These include, among others, the new building of the Mutual Life Insurance Co., of New York; residence of Henry G. Marquand, Esq., New York; residence corner Madison Avenue and Sixty-ninth Street; Berkshire Apartment-House; and residence of H. H. Cook, Esq., New York.

Steam-Fitting and Steam-Heating. By a practical steam-fitter, under the *nom de plume* of "Thermus." Continuation of series. Fully illustrated.

Public Urinals of Paris. Description, with sheet of illustrations.

English Plumbing Practice. By an English Journeyman Plumber. These articles are by a thorough workman, and of special interest to mechanics in any part of the globe.

New Method of Heating Two Boilers by One Water-Back. With illustrations and description.

The Syphonage and Ventilation of Traps. Criticism on the report of Messrs. Putnam and Rice on their experiments with traps, printed in the *American Architect*, and correspondence thereon.

Iron as a Material for Purifying Potable Water. By Prof. William Ripley Nichols.

Filtration of Certain Saline Solutions through Sand. Abstract of paper by Prof. Wm. Ripley Nichols.

Healthy Foundations for Houses. Series of papers, illustrated, by Glenn Brown, Architect.

Rights of Tenants occupying Insanitary Houses. Opinion of Justice Daly, of the Court of Common Pleas of New York.

Preventative Inoculation for Hydrophobia. Comments on experiments by Prof. Pasteur.

Sewerage of Waterbury. Description, with illustrated details.

New Orleans Quarantine Conference. Resolutions adopted and editorial comments on the same.

Improvements in the Hull General Infirmary. Illustrations giving plans and elevation, with descriptive matter.

Unbalanced and Lumped Bids. An elaborate communication showing the methods adopted in France and other European countries for letting contracts for engineering and other work.

The so-called Plumbers' Trade-Protection Controversy. A full and comprehensive history of the misunderstandings and controversy between certain plumbing societies and the manufacturers and dealers in plumbing materials in the United States during the autumn of 1884.

International Electrical Exhibition at Philadelphia.—Series of letters describing the exhibition, with illustrations.

System of Heating Houses in Germany and Austria. Illustrated article.

Pest-Holes in New York. Series of illustrated descriptions of some of the notable insanitary tenement-houses. Editorial comments charging the Board of Health with want of energy in dealing with these nuisances.

Cholera. Dr. Max Von Pettenkofer's views.

Public Baths and Wash-Houses. Illustrated description of notable public baths in London.

Blunders in Plumbing. Series of suggestive articles, with illustrations, showing the blunders made in arranging the plumbing details of houses. Notable by-passes in arranging trap-ventilation.

Heating and Ventilating Massachusetts Institute of Technology. Description of methods employed. By S. H. Woodbridge. Fully illustrated.

Aeration of Surface-Water. Editorial on report of Prof. Albert R. Leeds, on the results of the analysis of the Schuylkill water.

Checking the Waste of Water in Boston. Report showing very satisfactory results due to systematic effort.

Table giving Bids in Detail for Sections A and B of the New York Aqueduct. With editorial comments on the action of the Commissioners in rejecting these bids.

Reports by Special Correspondents. Of the proceedings of the International Congress of Hygiene at The Hague; American Public Health Association at St. Louis; the Plumbers' Congress, London; the Sanitary Institute at Dublin; National Convention of the Master Plumbers of the United States at Baltimore.

Bound in cloth, with index, $3. *Postage,* 40 *cents.*

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, 82 & 84 Fulton Street, New York. Obtainable at London Office, 92 & 93 Fleet Street, for 15s.

Steam.

STEAM-HEATING PROBLEMS. A section from the pages of THE SANITARY ENGINEER, *of questions and answers, also comments on problems met with in designing and constructing steam-heating apparatus. Large* 8vo., *handsomely bound. Sent post-paid on receipt of* $3.00. *Address Book Department,* THE SANITARY ENGINEER, 82 & 84 *Fulton Street, New York. P. O. Box* 3037.

Steam-Heating for Buildings;

OR, HINTS TO STEAM-FITTERS.

By WM. J. BALDWIN.

Seventh Edition, Price $2.50.

Being a Description of Steam-Heating Apparatus and for Warming and Ventilating Private Houses and Large Buildings, with Remarks on Steam, Water, and Air, in their Relations to Heating; to which are added useful miscellaneous tables. Sixth edition With many illustrative plates. 12mo, cloth.

Address, Book Department, THE SANITARY ENGINEER AND CONSTRUCTION RECORD, 82 and 84 Fulton Street, New York. P. O. Box 3037.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

VOLUME 15. NUMBER 20. } PUBLISHED EVERY SATURDAY.

NEW YORK, APRIL 16, 1887.

LONDON, APRIL 30, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. } IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

GAS FOR LIGHTING AND COOKING.

THE idea of supplying gas for cooking purposes at a lower figure than that used for lighting is finding many supporters among English and Continental engineers, although the cities and towns where such a system has been introduced are comparatively few.

In 1885 Mr. F. D. Marshall, Engineer of the Danish Gas Company, presented a paper on this subject to the Gas Institute; and a short article by the same person has appeared in a recent number of the *Journal of Gas-Lighting*.

The Danish Company, which supplies a number of towns in Denmark and North Germany, introduced the system in 1868, being induced to take the step from the success which had attended the efforts of the Corporation of Nakskov, who commenced the dual supply in 1863.

Mr. Marshall objects to the double index meter of M. Wybauw, preferring a system of two separate meters. One of these, which corresponds to the regular meter of the consumer, registers all the gas used, while the second meter is connected with the kitchen supply—the gas registered by the latter meter being deducted from the total amount.

As showing the benefit which consumers of lighting-gas derive from the system, the writer mentions the town of Nakskov, where in 1863 the price of lighting-gas was $1.80 per thousand, and 84 cents for cooking-gas. "By successive reductions they are now able to charge a uniform rate of 3*s.* 6*d.* (84 cents) for both cooking and lighting gas; and this without any loss of income."

The prices charged by the Danish Company are $1.20 for lighting-gas, 90 cents for cooking-gas, and 72 cents for motor-gas; and every effort is made to induce the people to use cooking-gas. In every town supplied by the company a woman is employed to give free instruction to consumers in the use of gas for cooking.

The effect of this policy is seen in the towns of Varde and Ribe in Denmark.

"In the former town the works were built in 1885, and they are already selling 50 per cent. of their production for cooking purposes, the prices being 5*s.* 9*d.* ($1.38) for lighting-gas, and 3*s.* 10*d.* (92 cents) for cooking-gas. In the second town (Ribe) they have only one price—viz., 4*s.* (96 cents)—for both lighting and cooking gas; and although these works were built in 1863, they do not sell 2 per cent. of gas for cooking." * * *

In speaking of the future of this system, the writer states that with them petroleum is a more formidable competitor than the electric-light; and he closes by admitting that the dual system offers few inducements to large companies, when the price of gas is already low.

BRIDGING THE HUDSON RIVER AT POUGHKEEPSIE.

WE have consistently opposed the bridging of navigable waters wherever the plans proposed were liable to cause either one of two effects and so impede or destroy commerce. These effects are, the actual obstruction of a stream by the physical obstacles placed in or over it, and the secondary obstruction caused by the formation of bars or the increased tidal or other currents.

While we shall continue to oppose all abridgement of the rights of navigation, and to advocate the improvement of natural channels, and in many cases the building of artificial channels, as being of real economic importance, and when done with due consideration of all the circumstances of each case, a wise expenditure of money, we cannot join in the cry which is being made against the bridge now building at Poughkeepsie.

The channel at the bridge site is over a half mile wide, and the character of the bottom shows that the currents are at no time, even in freshets, violent; the rise and fall of the tide is less than half of that at New York, so that the tidal currents are never severe.

The bridge as proposed gives *clear* spans over the channel as follows: Beginning at the Poughkeepsie end, 518 feet, with 160 feet from water to bottom of lower chord; next 500½ feet *between* piers and 130 feet clear height; next 521½ feet between and 160 feet, then 500½ feet and 130 feet; last 518 feet and 160 feet.

In a quiet time two of the widest and longest tows should have no difficulty in passing each other under any one of these spans, and with a strong cross-wind a single one ought surely to find no trouble in passing through alone.

We take up this matter because we think it is not to the interests of boatmen and vessel owners to ask too much, since if they become obstructers to the reasonable demands of land transportation, they lose the sympathy of the right-minded men who otherwise would be willing to defend them in their rights against opposing interests. No person will deny that it requires a little more *care* to navigate a tow or to sail past the bridge than if there were no piers; but to claim that they are dangerous obstructions or that the bridge will "cut the cheap water transportation from the head of the lakes to the seaboard in two," is a most manifest absurdity.

The bridge is high above the stream, and will certainly not obstruct the masts of vessels; and there is no reason to fear the formation of bars or dangerous currents, as there is sixty feet of water between the piers.

An additional argument can be drawn to the same purport from an examination of the charts of the waters in and about New York. It will be found that all the commerce passing to or from New York by way of Long Island Sound traverses channels not so wide as the spaces between these piers.

The channel through the Arthur Kill, also, which is traversed by immense tows of boats, is of about the same width.

In the efforts, therefore, of our Chamber of Commerce and Board of Trade to protect our water transportation the equally important movement by land should not be throttled, since both are necessary, and both are worthy of protection and full development.

THE Probate Judge and County Commissioners of Jefferson County, Ala., proposed to institute a competition for plans for a new court-house at Birmingham. A committee of the Alabama Association of Architects addressed the commissioners a polite note requesting that the terms of the competition should include substantially the provisions recommended by the Western Association of Architects at their convention a year or two ago, which provisions are deemed essential in any properly conducted architectural competition. The commissioners refused to make these provisions a part of the

terms of the competition, whereupon the Alabama Association of Architects passed resolutions, which are printed elsewhere in this issue. Their action is entirely proper under the circumstances, and it would be strange, indeed, if any architect of either capacity or self-respect in any part of the country, should offer plans for this building, in such a competition as these commissioners propose.

THE DETERMINATION OF ORGANIC MATTER IN AIR.

PROFESSOR T. CARNELLEY and W. Mackie, in the Proceedings of the Royal Society, Vol. XLI., p. 238, give the results of some experiments on this subject. The method of analysis used is a modification of that of Angus Smith —namely, by determining calorimetrically, by comparison with a standard, the fractional bleaching by a solution of permanganate of potash effected in a given volume of air. The objections to this process are: First, that it does not directly estimate the organic matter, but only measures the amount of oxygen which is taken up in oxidizing a portion of the organic matter; second, that the permanganate acts also on sulphureted hydrogen, nitrous acid, etc., as well as organic matter; third, that some kinds of organic matter will readily affect permanganate while others will not; and fourth, that there is no satisfactory means of checking the results.

The following shows the volume of oxygen required to oxidize the organic matter in 1,000,000 volumes of air:

Outside air, Dundee, 8.95; immediately after rain.
Outside air, Perth, 1.8; strong wind and rain.
In class-room, Perth, 7.7; 29 persons present for one hour.
In class-room, Perth, 4.5; 31 persons present for one hour.
In a small room, with one person and one gas-jet, after 1 hour and 40 minutes' occupancy, 17.1.

Such results as these, and especially those in the class-room at Perth, would seem to indicate that the method is of very little value.

From the results of a large number of analyses the investigators concluded that the organic matter in outside air has a far wider range of variations than carbonic acid, and is also subject to more rapid fluctuation. Respired air gives a higher result than unrespired air, though much less than was anticipated.

OUR BRITISH CORRESPONDENCE.

Method of Conducting an Official Inquiry at Manchester— Manchester Ship Canal — English Water-Works Undertakings.

LONDON, March 30, 1887.

AN inquiry of an extraordinary nature is being conducted in Manchester, the Corporation supplying counsel for plaintiff and defendant alike, with a view to the elucidation of the facts. It appears that the Health Committee of the Corporation are large manufacturers of manure, soap and bricks, etc., autocratic authority in the matter being vested in a Mr. Whiley. The Corporation auditors allege malversation of funds in various directions, deficiencies being alleged in the accounts of each department in the form of payments for wages where no work has been done, in arrangements with contractors, etc., etc.

The directors of the Manchester Ship-Canal Company are again attempting to push the matter forward by pointing out that the limit of time for their provisional powers of construction will lapse with the 6th of August next. They are naturally anxious to get the money for the scheme, and point out its many advantages. The proprietors of the money, however, do not seem to appreciate the advantages in the same way as the directors.

Some interesting figures relating to the reserves of the leading corporation water companies were quoted by Mr. Hawksley before the House of Lords' Committee on the New Sheffield Water Company bill. He stated that Manchester is adding 50,000,000 gallons additional to its present supply of 25,000,000 gallons daily; the Liverpool reservoir would deliver, when complete, 40,000,000 gallons, as against 12,000,000 to 13,000,000, the present daily supply; Leeds is providing for a future supply of 25,000,000, as against a present use of 10,000,000, while Glasgow is taking steps to bring in an additional 50,000,000 daily, its tunnels for the purpose being some twenty to thirty miles in length. The present Sheffield supply, with a drainage area of some 15,200 acres, is about 19,000,000, out of which there is a compensation to mill-owners of 9,125,000 gallons, leaving available about 10,000,000 gallons, giving a reserve of about 16,000,000.

SAFETY VALVE.

SEWAGE-SLUDGE.

AT a recent meeting of the Institution of Civil Engineers, Mr. W. J. Dibdin, of the Metropolitan Board of Works, read a paper on sewage-sludge and its disposal, in which the effects of various chemicals used for the purification of sewage were considered. The use of an excessive quantity of lime, while causing rapid settlement of the sludge, caused the solution of a considerable quantity of the organic matters previously held in suspension. The fluid pressed from sludge treated with lime contains a large proportion of organic matter and is liable to be very offensive. The use of iron sulphate was recommended in preference to alumina. With London sewage as much work can be done for £31,000 per annum if expended for sulphate of iron with lime, as can be done for £82,000 if expended for lime and alumina.

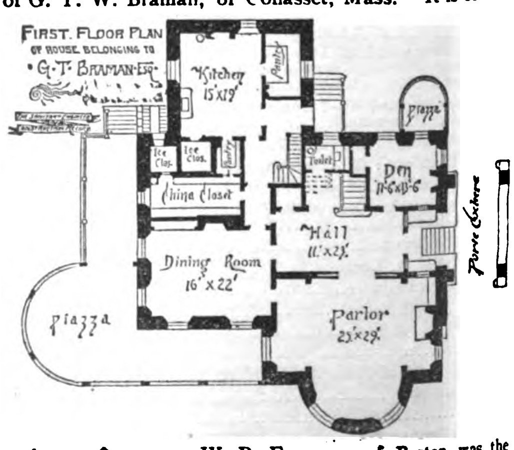
As regards the disposal of sludge derived from precipitation processes he was not inclined to think that there would be much demand for it from farmers, and thought that in place of the farm in many cases the furnace would be the destination of this matter. The system recommended for the disposal of the sludge from the London sewage was the carrying it out to sea in specially constructed vessels and discharging it into water several miles from land.

RESIDENCE OF MR. JOHN C. KIRTLAND, ORANGE, N. J.—W. HALSEY WOOD, ARCHITECT.

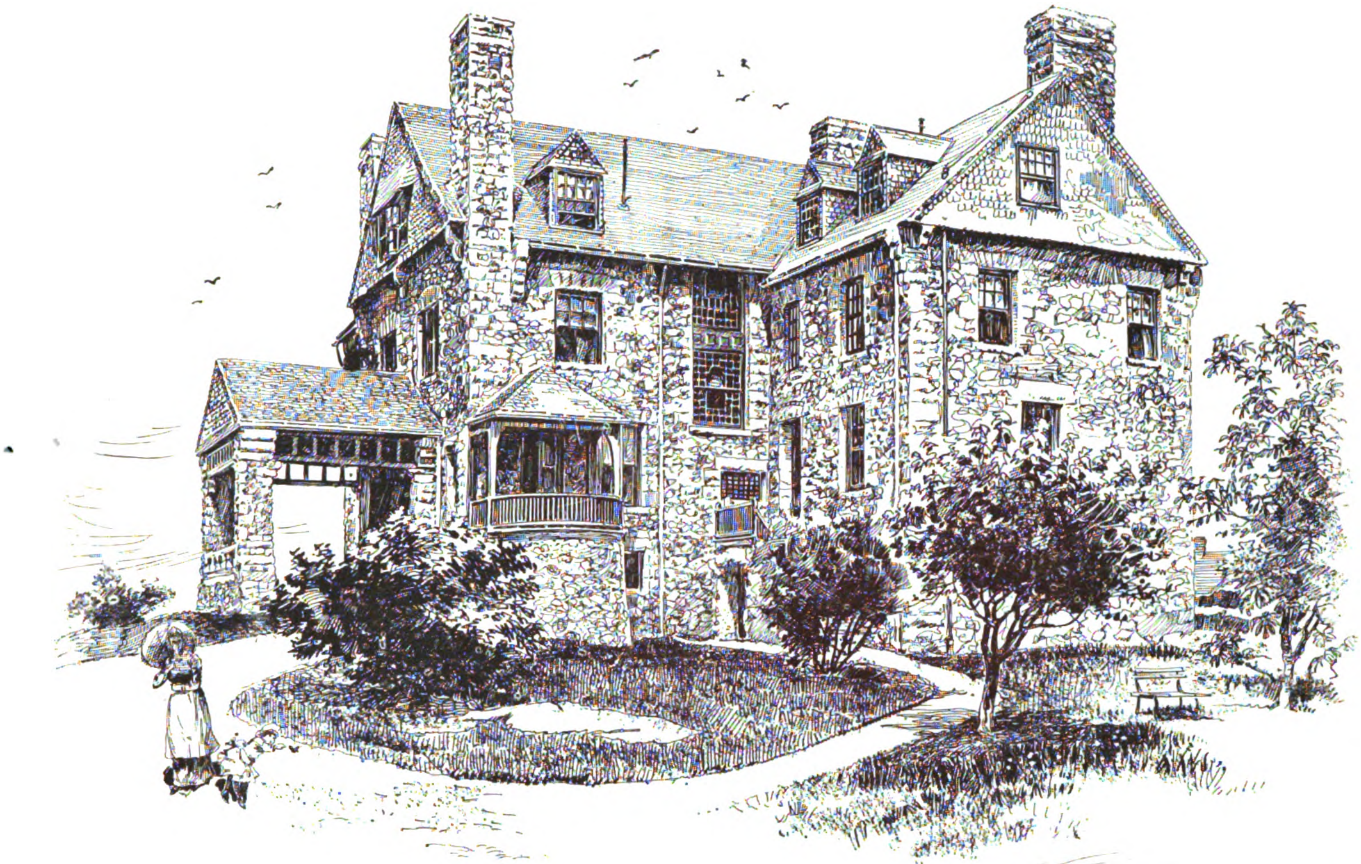
OUR SPECIAL ILLUSTRATION.

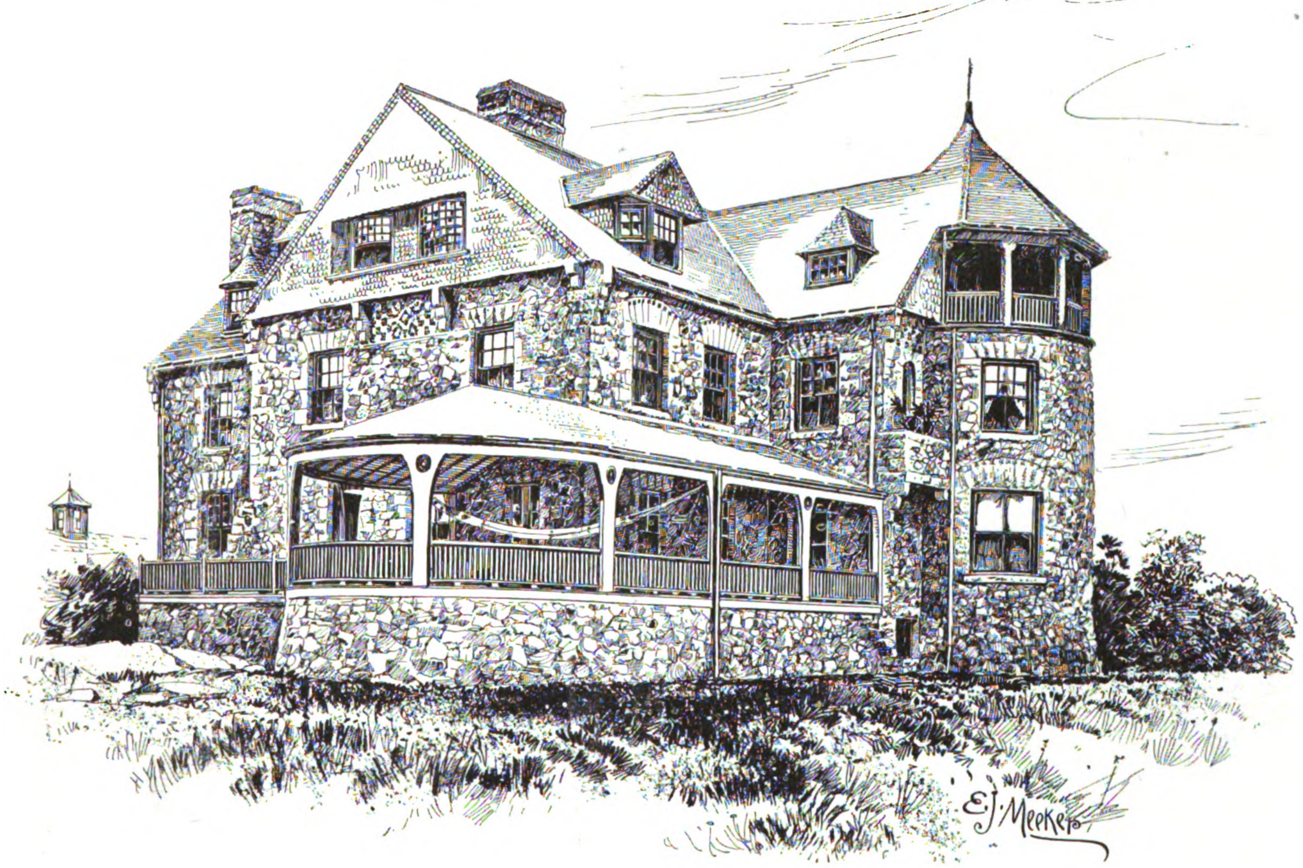
RESIDENCE AT COHASSET, MASS.—W. R. EMERSON, ARCHITECT.

THE subject of our special illustration is the residence of G. T. W. Braman, of Cohasset, Mass. It is of stone



and cost $25,000. W. R. Emerson, of Boston, was the architect.





THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCE OF G. T. W. BRAMAN, ESQ., COHASSET, MASS.

W. R. EMERSON, ARCHITECT.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

A RESIDENCE AT ORANGE, N. J.—W. HALSEY WOOD, ARCHITECT.

THE subject of our vignette illustration is the residence of Mr. John C. Kirtland, Orange, N. J. The material is stone, brick, wood, and slate. Interior cabinet-finish moldings, hard-wood walls, decorated wood floors, open chimney in each room. Cost, including barn, $10,500. The architect was W. Halsey Wood, of Newark, N. J., and New York.

THE AUGUSTA FREE HOSPITAL, ST. LOUIS, MO.—WILLIAM S. EAMES AND THOMAS S. YOUNG, ARCHITECTS.

THE Augusta Free Hospital, of which we give an illustration, is situated in St. Louis, Mo. The exterior is of native limestone for the foundation, walls of red brick, with red sandstone trimmings, and shingled gables and roofs stained with oil and umber. The interior finish is of yellow pine, with hard oil rubber finish and painted white pine. The kitchen, baths, furnaces, laundry, and dispensary rooms are in the basement. The cost of the building was $10,600. Messrs. William S. Eames and Thomas S. Young, of St. Louis, were the architects.

IN a letter to *Engineering* Mr. J. Haddock comments on the plans for a breakwater for the port of Buenos Ayres, saying that "as regards the construction of docks in front of the city and in this warm climate, it is questionable if such be a wise policy in a sanitary point of view. We are unpleasantly reminded of this during the present visitation of cholera; the water in the Riachuelo has become so foul that all the shipping has been sent out of the port to the outer roads—*à fortiori*, will not the nuisance be much worse in enclosed docks immediately in front of this populous city? If the dock accommodation were simply to consist of piers projecting from the quay wall, there would be no fear of stagnant water accumulating in front of the city, as the current of the River Plate would thoroughly cleanse the harbor and materially assist in sluicing the entrance channels."

ENGINEERING & ARCHITECTURE

REGARDING THE STUDY OF ARCHITECTURE.

WE print the following letter on this subject in continuation of those published on pages 463 and 483.

Mr. W. L. B. Jenney, of Chicago, writes:

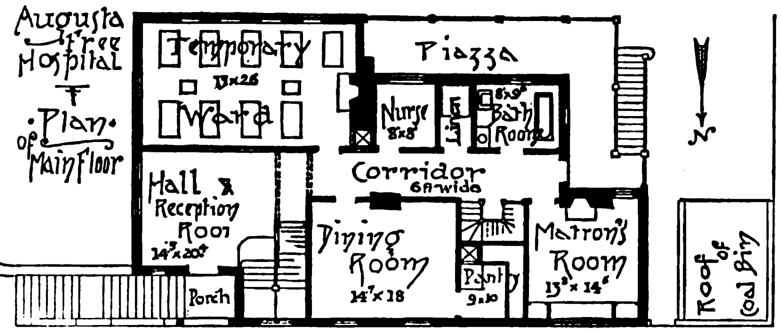
"It is essential that an architect should have a thorough technical training. The better preparation he has on entering the technical school the more rapid will be his progress. The same is true in regard to office education; therefore, there must be a sort of compromise. It is necessary that the student should draw fairly well before entering the technical school or he will be at a disadvantage, and for this reason it is well that he should take a few months' practice in an office. This office experience will be otherwise valuable in giving him an insight into the duties of an architect's assistant, and in affording him some practical information of building details not usually taught in the schools.

"I would, therefore, advise that a student should spend from six months to a year in an architect's office before entering a professional school, unless he has had elsewhere a somewhat similar experience, as, for example, in the Manual Training School. He should not confine himself to mathematical drawing, but should practice free-hand drawing with pen and ink, and also water-color painting in a free sketchy style (read Ruskin's Elementary Drawing). He should, when the weather is favorable, make out-of-door sketches, both in pencil and in water color, of buildings, of details, and any picturesque objects, and even of landscapes. A free use of the pencil and color-box is of the greatest use to an architect through life, and one cannot begin this practice too early nor do too much of it. As the student has the freedom of the office rather than the position of an apprentice draughtsman, he cannot expect any other remuneration.

"Let him read Viollet Le Duc's "Story of a House" and "Habitations of Man," and the current architectural journals. Let him glance over Ruskin's "Seven Lamps of Architecture" and "The Stones of Venice," reading such parts as interest him, remembering that Ruskin is an art critic and not an architect, and that some of his theories are not sustained by the facts.

"It is necessary that a student should at an early date obtain some general knowledge of the styles. Let him accept as proven that architectural styles were evolved and not created, that each style in its turn was derived from all that had gone before modified by the environment and the race characteristics, then the study of architecture becomes the study of a science and of more interest and benefit than it can be otherwise."

THE AUGUSTA FREE HOSPITAL, ST. LOUIS, MO.—EAMES & YOUNG, ARCHITECTS.



GERMAN PARQUETRY IN ENGLAND.

"A GERMAN firm prepare parquetry for flooring at Altona, near Hamburg, and can successfully compete with English contractors, having recently laid floors at several buildings in London—viz., the Baltic salesrooms, the Scottish Imperial Insurance Company, the Union Bank of Australia, etc. The oak is generally German grown, but sometimes brought from Russia and Austria. The work is very simple: the floors are laid on open-jointed deal supports, the oak being about 2 feet 6 inches long, 4 inches wide, and 1 inch thick; these pieces are laid in 'herring-bone' courses, grooved and cross-tongued all around, and secret nailed. The battens are prepared at Latoria, being first thoroughly dried and worked to exact sizes. They are then packed in bundles, and sent by ship to London and laid by Swiss and German workmen. These men are very fugal and temperate in their habits. They work much longer hours than the Englishman, working with a will, and take a great pride and interest in all they do. The oak 'herring-bone' parquetry floor is laid complete and twice waxed for *1s. 4d.* per square foot super."—MR. BANNISTER FLETCHER, *in Building News.*

MODERN SEWER CONSTRUCTION AND SEWAGE DISPOSAL.

BY EDWARD S. PHILBRICK, MEM. AM. SOC. C. E.

No. V.

(Continued from page 346.)

IT was not until July 17, 1876, that an appropriation was voted by the City Government for carrying into effect the recommendations of the commission above referred to. Even then the money voted was limited to the cost of such surveys and study of the plans in detail as might present the subject in a practical shape, ready for the making of contracts.

The subject of the Boston sewers was then placed in the hands of the City Engineer, Mr. Joseph P. Davis, who at once began the necessary investigations for the study of the best methods of carrying out the general views of the commissioners, above quoted.

In order to verify the correctness of the opinion as to Moon Island being the best place of discharge within the bay, experiments were made by means of about fifty floats liberated in the ebb-tidal currents near Moon Island, Castle Island, Thompson's Island, and Spectacle Island. The form of float adopted after several trials was a pole fourteen feet long, with a sinker at the bottom and a small flag and lantern hook above water at top. This indicated "the mean current, which often differed, both in direction and velocity, from the surface current." The position of these floats was determined by triangulation with sextant each half hour. Their trips varied from six hours to fifty-two hours. The average indications were about equally in favor of Castle Island and Moon Island as a point of discharge. The latter was chosen because the land was more easily acquired. The other points showed less favorable results. The average trip during the first ebb tide was about four miles to the seaward. The returning flood brought the floats back some two miles towards the city, and the next ebb took them quite out to sea, not to return again. Since sewage was expected to float on the salt water, experiments were made to test the surface currents, as follows: "Fifty bottles were put into the water at Moon Island, each containing a postal card which the finder was requested to mail, stating when and where it was found. Ten of these bottles were picked up within the next three weeks. One had traveled to Marshfield, twenty-five miles south along the coast; another went to Salem, about as far north; a third at sea, thirty miles south-east of Cape Ann, and seven more quite outside of Cape Cod, from fifty to eighty miles from their starting point." [Clarke's Report.]

Having fixed upon the point of discharge, the best route of the main sewer was then a subject of investigation. After various surveys, including borings through the different strata overlying the rock foundation, the route selected was as follows: (See map published opposite p. 234, issue of February 5, current volume.) Commencing at Moon Island, the route reached the mainland at Squantum Neck by a solid embankment, about a mile long; thence it crossed the mouth of Dorchester Bay by a tunnel to "Old Harbor Point," about two miles more, where the pumping-station was located. This portion between the pumps and Moon Island was built with a flow-line about thirty feet higher than the western portion. This latter followed in as direct a line as practicable, using existing streets as far as possible, across the isthmus of South Boston peninsula and the head of "South Bay" and across the low lands of "Boston Neck" to a point at the corner of Huntingdon Avenue and Camden Street, near the Back Bay Park, about 3¼ miles from the pumping-station. The inclination for the whole of this distance is one in 2,500. At the pumping-station the level of the invert is fourteen feet below mean low water of the tide, which has an average daily rise of ten feet. By this means the low districts of the city about "Boston Neck" were provided with efficient drainage for all their house-sewage, as well as for such surface-water as would find its way into cellars, with a limited amount of storm-water up to the capacity of the pumps. The total cost of this main sewer, $3\frac{3}{16}$ miles in length and of various sizes, averaged $36.09 per lineal foot. The accompanying plate, copied from Mr. Clarke's book, shows the different forms of construction used under different circumstances, together with forms of manholes, etc.

(TO BE CONTINUED.)

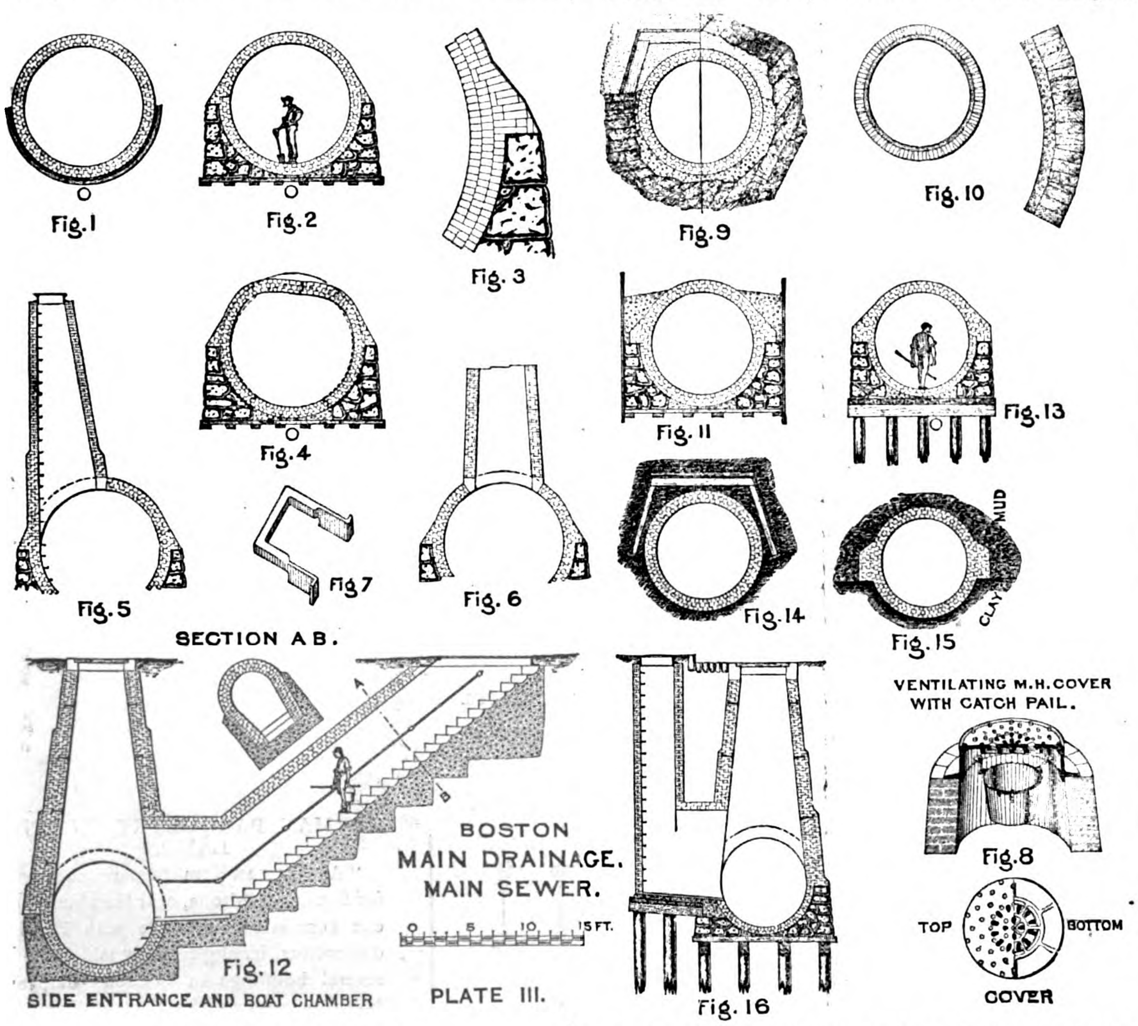


PLATE III.

EXPLANATION OF PLATE III.

Figs. 1, 2, and 3 show mode of construction of main sewer through "Calf-Pasture Marsh;" average depth of trench, twenty-four feet; material, clay and sand; inside diameter, ten feet six inches.

Fig. 4 shows distortion caused by careless back-filling at a point some 150 feet in length, where the mud occurred as deep below the surface as below the middle of the sewer. The defective portion was uncovered, broken down by sledge-hammers, and rebuilt.

Figs. 5 and 6 show method of placing manholes alternately over centre and sides of sewer about 400 feet apart.

Fig. 7 shows iron steps built into manhole walls.

Fig. 8 shows details of manhole cover and pail to catch road detritus dropping through vent-holes in cover.

Fig. 9 shows construction in tunnel made through South Boston Neck; nine feet diameter.

Fig. 10 shows timber sewer, with brick or concrete lining, nine feet in diameter, built for about 1,900 feet in length in an embankment recently constructed for Chester Park Street across a deposit of mud some eighty-six feet deep in places. Settlement took place to the extent of eighteen inches after construction, over the deepest filling, without injuring the structure, which showed considerable flexibility.

Fig. 11 shows method used with heavy sheeting on sides and concrete filling, adopted where passing near a large gas-holder tank.

Fig. 12 shows section of side entrance for admitting boats into the sewer at the corner of Swett Street.

Fig. 13 shows pile foundation used in crossing some 300 feet of deep mud between Albany and Camden Streets.

Figs. 14 shows form adopted in tunneling through mud and clay where passing below local sewers at a considerable depth below the surface. This structure cost $22.52 per linear foot and is 8′5″x8′3″ diameter inside.

Fig. 15 shows method used in an open cut, above Tremont Street, though piling and side walls were needed for a large part of this section.

Fig 16 shows a side entrance for boats built near the Providence R R.

REMOVAL OF SHALLOW FLOWAGE FROM THE BOSTON STORAGE RESERVOIRS.

BY DESMOND FITZGERALD, MEM. AM. SOC. C. E., RESIDENT ENGINEER.

No. II.

(Concluded from page 484.)

BEFORE describing the work performed in the way of removing the shallow flowage from the Boston storage reservoirs it may be well to give a short description of their situation. As will be seen on the accompanying map, Reservoir No. I. or Basin No. I. as it is commonly known, is at the juncture of the two streams which form the Sudbury River. This basin has no water-shed of its own and its office is more particularly to reduce the head on the dams above it and to supply the river below with water required by law. The water from all the basins above can be drawn through Basin I. by means of pipe-lines laid in its bed, and without mingling with its waters, so it has not been thought necessary to spend any money upon the removal of its shallow flowage. Basin No. II. is on the southerly or main branch of the river, and is a narrow body of water some two miles in length. The area of its contributing water-shed is about forty-five square miles. Basin No. III. is on the Stony Brook branch. It is fed by a water-shed of about thirty square miles. The water is twenty-five feet deep in the lower portion of No. III., while in No. II. the depth is eighteen feet. The length of the two basins is about the same. Succeeding the report and recommendations of the special commission, already referred to, came an appropriation from the City Council for the removal of the shallow flowage from the above basins. During the early part of the summer of 1883, Basin No. II. was drawn down for the supply of the city, and by the middle of July the old meadows bordering the original stream were exposed. The season was one of unusual drought, and the sides drained quickly, leaving the basin in an unusually favorable condition for the work of removing the shallow flowage.

Stated briefly, this treatment, as recommended, consisted in filling all the shallow places on the borders of the basin, and excavating others to furnish the material, the result being to leave nowhere less than eight feet of water when the basin is full. When this plan is carried out in the upper portion of the valley, which is artificially dammed to make a reservoir, it will be found necessary to take out the bottom as well as the sides to secure the required depth, and no matter what the character of the material, whether clean gravel or rock, it has to come out. Fortunately, in the cases where the writer has had occasion to apply a shallow flowage treatment, the valleys were very narrow at the upper ends and the width of the bottom limited. The bottoms of a river valley, too, are almost always covered with a layer of loam, muck, or mud several feet in depth, and even where clean gravel has to be excavated it can be applied to covering the sides or exposed portions of the new embankment, formed by filling the shallow portions. In the case of Basin II. it was necessary to begin work before the engineering force was ready with their sections. A day force of about 100 men and twenty teams were set at work in a portion of the basin where it was evident that work could be done to advantage, and in the meantime a force of engineers were started on the contours.

On August 13, a contract was made by the Boston Water Board with Messrs. Munson & Co. to excavate 30,000 cubic yards of loam and gravel at twenty-eight cents per yard, and on September 17, when this amount had been moved, 25,000 cubic yards more were let to the same firm at the same price. It became evident as the season progressed that, owing to the almost entire absence of rains, the work could be advanced in every part of the basin; accordingly a very large day force was organized and con-

tract work was pushed at every available point, the result being that by the close of the year the whole work of deepening the margins had been accomplished. It is unnecessary to go into the details of the different portions treated. In a general way the following method was pursued: When the levels for the contours were taken, notes were also taken of the character of the ground, the depth of the mud or loam, and the kind of material underlying the same.

After a study had been made as to the general way to treat different portions of the basin, the margins were divided into sections separated by natural peculiarities of topography. In each of these sections—say for every 500 feet—the quantities were made to balance, the excavations just forming the fills. This gave an idea of the new lines around the basin, and by fitting adjoining sections together and modifying the line to form a connected whole, the sections could be correspondingly modified.

The total quantity of material excavated in Basin II. was 148,129 cubic yards. There were 13,381 square yards of rip-raps, and 758 cubic yards of stone-paving placed, and 359 cubic yards of culvert-masonry built, at a total cost of about $71,500.

The slopes generally adopted for the gravel facings or dams in front of the mud fillings were three to one, but where the material was sandy in its nature the slopes were either made flatter or else covered with rip-rap, if stone was close at hand and had to be moved.

The gravel facings were of a minimum thickness of three feet and were more often ten feet thick.

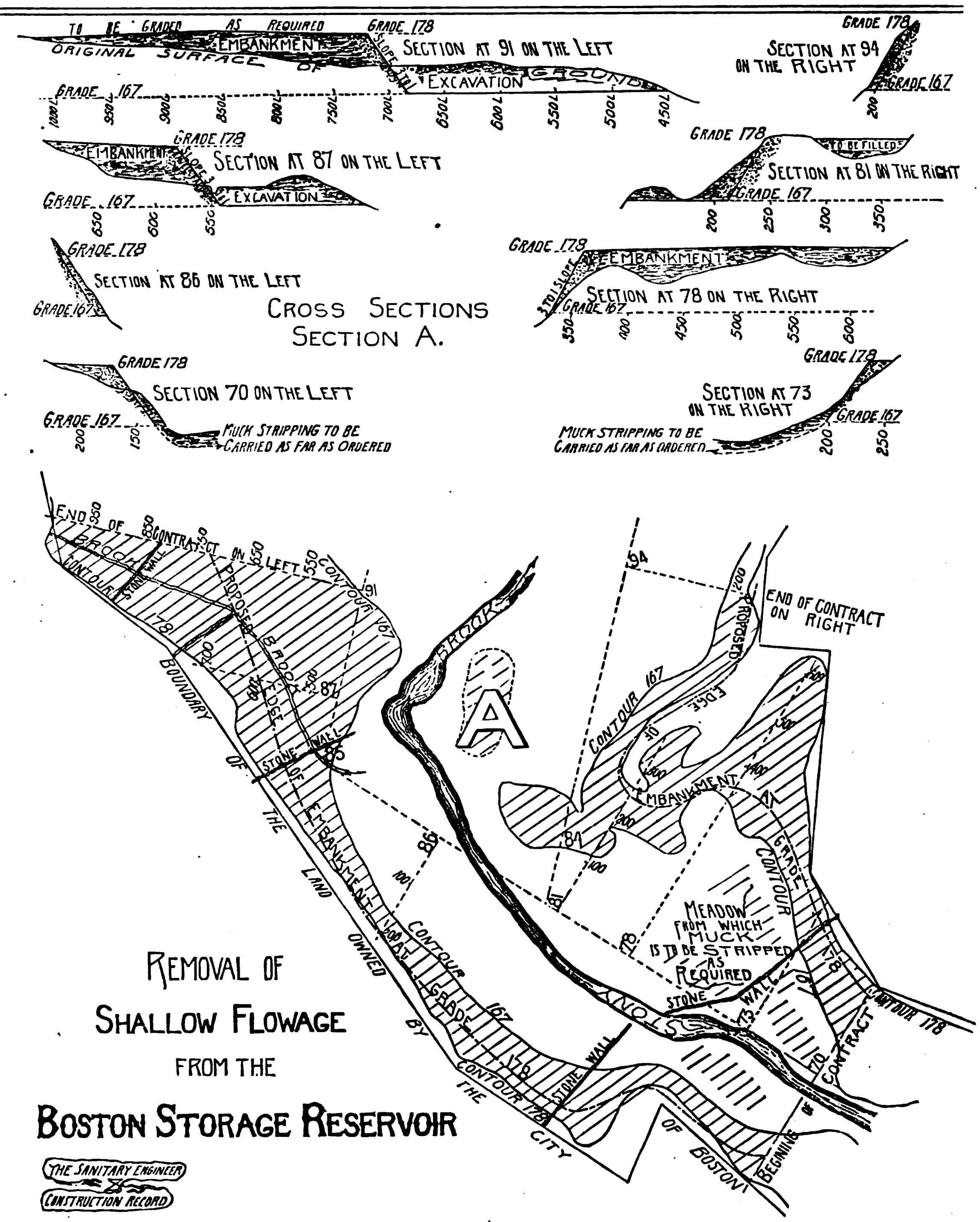
Projecting points of land where they were exposed to the force of the wind and waves were generally protected with stone. It may be stated that the work accomplished really gave more than the eight feet determined upon. There is hardly a spot in the basin of less depth than ten feet, and whenever stumps or other undesirable material was encountered below the shallow flowage limit it was removed, irrespective of any fixed grade.

The following table will show the kind of work done in Basin No. II.:

Work done on Shallow Flowage Basin No. II. between August 1 and December 31, 1883.

Subdivision.	Shallow Flowage. Loam. Cu. yds.	Sand and Gravel. Cu. yds.	Cemented Gravel. Cu. yds.	Loose Rock. Cu. yds.	Solid Rock. Cu. yds.	Below Shallow Flowage, Loam. Cu. yds.	Total Excavations. Cu. yds.	Rip rap. Sq. yds.	Paving. Sq. yds.	Culvert Masonry. Cu. yds.
"A" "A"	......	100	......	100	......	......	200	237	...	...
"B"	9,754	......	4,200	2,010	1,620	......	17,584	2,070	741	...
"C"	33,085	10,000	10,000	760	22	......	53,867	1,105	17	111
"D"	6,408	1,765	......	2,168	505	13,066	23,912	8,868	...	248
"Old road"	......	1,620	......	810	......	......	2,430	......	...	...
"E"	2,505	2,825	......	420	......	15,965	21,715	1,011	...	...
"F"	6,977	15,070	......	74	......	6,300	28,421	......	...	...
	58,729	31,380	14,200	6,342	2,147	35,331	148,129	13,381	758	359

While the above excavations were under way about $35,000 was expended in starting the work at Basin III. In this basin the area of shallow flowage was very much larger and the country more remote from towns. Shanties and boarding-houses, therefore, had to be built. Quite a large meadow near the upper end was excavated and partly filled before the close of the season, but it was determined when the winter flow began to fill the basin to postpone the principal part of the work until a new basin then in process of construction (No. IV.) could be completed and its water used for reinforcing the supply. The whole amount of the appropriation for Basin No. III. was $125,000. It was not until 1886 that it became possible to undertake the completion of Basin III. All the preliminary engineering-work and the study of the sections



was, however, finished, and before the frost was out of the ground in 1886 contracts were prepared for the excavation of five sections in the more important parts of the work. About 3,000 feet of the upper or influent end was left to be done by day's labor, as this work was of such a character that it might be done to a greater or less extent, according to the balances left after the contracts had all been let. As in Basin II., the shallow flowage-line was drawn at a depth of ten feet below high-water mark. The five sections above alluded to were designated as A, B, C, D, and E, and they involved the removal of 130,000 cubic yards of mud, loam, gravel, etc. (The work on Section A is partly shown in drawing annexed.) The haul was generally from 200 to 400 feet. The bids ranged from twenty-four to seventy-five cents per cubic yard, and they were finally let as follows: Sections A, 25,331 cubic yards, B, 16,640 cubic yards, and C, 15,512 cubic yards, were awarded to Neil McBride, of Waltham, for twenty-seven cents per cubic yard; D, 41,542 cubic yards, and E, 40,637 cubic yards, to Silas H. Munson, of Boston, for twenty-nine cents and thirty-one cents, respectively. Five more sections were subsequently let as follows: Section F, 19,486 cubic yards, at 23 cents per cubic yard, Neil McBride, of Waltham; G, 13,770 cubic yards, at 24 cents per cubic yard, John R. Rooke, of Framingham; H, 12,320 cubic yards, at $25\frac{7}{10}$ cents per cubic yard, Joseph McNamara, of Hudson; I, 15,843 cubic yards, at $24\frac{7}{10}$ cents per cubic yard, Joseph McNamara, Hudson; J, 9,448 cubic yards, at $22\frac{1}{2}$ cents per cubic yard, Joseph McNamara, Hudson.

The prices quoted for which the work was let included the removal of all obstructions, such as stone walls, trees, etc., wherever they existed, the grubbing out and destroying of all stumps, placing the mud and loam where directed by the engineer, and the building of the gravel banks on the front or water side. The work was all completed before the end of the working season.

When the water was all drawn out of Basin III. and its sides and bottom carefully examined it became evident that for the eight years that the basin had been in use nature had been hard at work trying to form gravelly shores around its margins. The loam was washed down in many places several feet in depth, and on the steeper sides of the valley it was partly covered by shallow gravel washings. The only way to make a thorough job of such a situation was to cut down the banks to the gravel, which was done in every case.

About 12,000 stumps were removed from different portions of the basin, the larger part of them being below the limits of shallow flowage. The upper portions of the valley in Basin III. were very shallow and largely composed of meadows and a rank growth of grassy vegetation not much more than covered at high water. The work of improvement at this point consisted in digging out a central channel down to the gravel and filling up the sides to one foot above the highest flow-line. About 56,000 cubic yards have been moved in these portions.

Where the brooks enter the basin the plan has been followed of leaving plenty of open waterway for freshets in the artificial embankments—in other words, to disturb their natural beds as little as possible—but in some cases it was thought advisable to alter their courses, unite their channels, or build new outlets. On October 7 the work was so far completed that the gates were closed and the basin allowed to fill. Its contents are about 1,100,000,000 gallons.

As analyses of the waters in these several basins have been made every three months in the past it will be possible in the future to trace the influence of the work which

has been expended in removing the shallow flowage. It is too soon to hazard an opinion on this point, but it seems impossible to suppose that the treatment can have any other effect than to improve the quality of the water. For the maintenance of her supply Boston has to store not far from 6,000,000,000 gallons to tide over the dry months of the year.

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

No. VI.

(Continued from page 435.)

THE fourth variety was coarse-grained yellowish. It is quite compact, so that little pitting is found on it. It contains no carbonate of lime. The quartz is in closely-packed grains, generally clear, but containing some inclusions. The grains are angular. The orthoclase is also angular, some of the grains being cloudy. The plagioclase is also angular, and polarizes the light strongly. The biotite and hydro-biotite are in yellowish-green scales. The other minerals are margarodite, epidote, amphibole, sericite, magnetite, and iron ochre. No pitting occurs, except in the specimens in which there are red flakes, and here it is quite deep. The specimens where this occurs were taken from the outside of the church near the ground, where they were exposed not only to the action of the weather, but to that of the dampness coming from the ground as well. The composition of these specimens is given below:

	1.	2.	3.	Average.
Quartz	40	70	57	56
Orthoclase	53	18	31	34
Cement	7	12	12	10

With regard to all of the stones, it may be said that the disintegration is not caused by either the looseness of aggregation of the particles, nor by the structure of the stone. In all the specimens there was shown great compactness and no cavities, except occasionally when grains had fallen out owing to the absorption of the binding material. It was not influenced by structure, for while there is an abundance of mica, the splitting is as much across the mica plane as in it. If anything, the mica, though acted on, seems to have played, to some extent, the part of a binding material.

The disintegration is not owing to the decomposition of the feldspar, most of which belongs to the variety orthoclase, which decomposes with comparative ease. It is to be noticed that the average amount of orthoclase in the specimens examined was between twenty-nine and thirty per cent. Most of these grains were more or less decomposed, but there was no evidence to show that the decomposition has progressed to any extent since the consolidation of the sand into stone. On the contrary, it seems to have been completely arrested. This is shown by the fact, that in the most highly-weathered specimens, the proportion of milky grains of feldspar showing inclusions and the commencement of decomposition is no greater, and the decomposition no further advanced than in the fresh ones. The stone seems to have been formed out of the destruction of granitic rocks, which had commenced to decompose during the trias previous to their destruction, and to have been consolidated under immense pressure, as is shown by the crumpled and irregularly broken and curved mica plates, and the compact nature and close union of the grains.

It appears, however, that some decomposition has actually taken place in the minerals of the stone since its consolidation into rock form. This is shown in the condition of the iron micas, both the biotite and hydro-biotite, which contains from five to twenty-five per cent. of ferrous oxide, from one to four per cent. of water, which readily decompose. That some decomposition has taken place in it is shown by the varying color of the mineral, individual pieces being mottled brown and green, and also by the action of polarized light upon them, as well as by the fact that their passage into chlorite and iron ochre can be distinctly seen. Part of this decomposition is seen in the unaltered stones, but it is much more prominent in the weathered ones, and while of itself it would have had but little influence in weakening the stone, it undoubtedly put the constituents into a form in which they would be more easily attacked. A very slight alteration in the margarodite, amphibole, and garnet is seen. While this decomposition is not sufficient to account for the entire weathering of the stone, it undoubtedly contributed, although slightly, to it, as at the most it could weaken the stone but little. It is, however, to be observed that the mineral calcite is present in every one of the unaltered specimens except the last variety, which consisted of three specimens out of the thirty examined, and that in all the weathered varieties this was either wanting entirely or present in very small quantities, and that wherever it was dissolved out to a small extent, there the stone was pitted, and when entirely gone, honeycombed, rendering that part of the stone porous and open on the outside. How far the iron has been removed at the same time as the lime, cannot be stated. There has been no very great change in the color of the stone—certainly not sufficient for us to suppose the removal of any large quantity of iron oxide, and but little that may not be accounted for by the presence of small quantities of carbon deposited at the bottom of the pittings in the stone. The decay is deep-seated, penetrating, at times, several inches into the stone, which still looks sound on the outside, not showing the least trace of flaking; but in no case is the lime entirely wanting from the interior of the stone, even when it has been entirely dissolved from the surface. The removal of even a very small quantity of lime would render the ochreous material which is so abundant much less stable, and far more likely to be acted on. It is not very homogeneous in any part of the stone, but is much less so where the calcite is gone. This action on the iron, while it could not go on at any great depth from the surface, and so could not weaken the stone much in the interior, was at its maximum on the outside of the stone; and, as it was already porous from the solution of part of its binding material, this rendered it likely to flake at short distances from the surface, the stone falling off in layers along the lines of least resistance, corresponding to the plane which included the greatest number of pit bottoms, and consequently give an appearance of lamination in the stone which did not exist in the stone itself. Frost would separate such stone into lamellæ very rapidly.

Independent of all these considerations, is the fact that there is in all these stones a certain amount of organic matter, which can easily be detected on heating the stone by the empyreumatic odor which it gives out. The microscope does not show any vegetable matter, nor in most of the stone, any traces of carbon which is not in a state of combination. It is well known that organic acids form combinations with bases, which combinations are decomposed when submitted to the continued action of moisture, and will be all the more rapid as this moisture is slightly acid, as it is in all cities. It is most common to find, either in or in the vicinity of these rocks, large quantities of organic materials, either fossilized, such as plants, lignite, coal, asphalt, or combined with basis. Asphalt was actual found in very small quantities, in two specimens of decomposed stone. In other sandstones organic acids have been found. It is more than probable that they would be found much oftener if looked for. The expense of such investigation, however, generally prevents their being made. Dr. Julian has called attention to the fact that the ochreous condition of sandstones of different geological ages is not the same. In those of the paleozoic periods it is hematite, which frequently produces such a permanent cement as to make a durable building-stone. In the tertiary it is turgite or limonite, and in so small quantity as to produce in many cases only sand rocks. I once had occasion, in the Far West, to examine the abutments of a railroad bridge built of stone excavated in the winter from such a quarry, and found that the rock, though apparently strong, could be rubbed into sand with the fingers. In the sandstones of intermediate geological ages, göthite predominates, and it is in variable quantities in different layers of the same bed making the rock correspondingly strong or weak. The range of the variation is so great as to imply the possible association of organic acids with the iron oxide. Whatever may be the cause of the decay, it is not loose consolidation of the rock. It is not wholly explained by the solution of the calcareous matter, but it is undoubtedly hastened by it. It had progressed somewhat in the quarry before the stone was put into the church, and is still going on. The flaking of the stone in thin parallel layers is perfectly explained by the solution of the lime, but the deep-seated decay needs further study, as the action of the acid, waters, and gases does does not fully explain it. The flaking is hastened by the heat of summer and the frost of winter, and is always most prominent where there is any drip of water.

It is certain that the decay can be retarded, even in the buildings which were constructed twenty or thirty years ago, so as to make them last for many years. It is not certain that it can be completely arrested. The decay in Trinity Church is one of the best examples that could have been chosen, for it applies to one of the most compact and well-selected building stones of the country, which was selected at the time on account of its supposed durability. It is certain that from the same quarry, by a careful selection of stones with siliceous binding materials, and the rejection of all others, materials might have been selected that would have lasted indefinitely.

It has been usual to consider all sandstones as good for building purposes, or not, according as they were compact or more or less porous, and this rule has undoubtedly influenced the choice of the stone which has been used, which is in this respect an extremely good one. The theory generally accepted is that the porous stones absorb moisture, which in the cold of winter freezes and, expanding, disintegrates the stone; and that the heat of the sun also contributes its share to the expansion, which causes the flaking. This cannot be said to be true to any great extent of the stone of Trinity Church, except where the moisture from the defective cutting of the moldings has not been shed from the surface, and has been constantly dripping on the stones below. It is specially observable that on all the faces of the building underneath projecting stone, whether it has had moldings cut on it or not, the stone has decomposed more or less. It is a remarkable fact that in all of the specimens taken from all parts of the church, both inside and out, and representing so many varieties of stone, no iron pyrites has been found, and consequently no such cause of disintegration as often produces decay in other building materials can be ascribed to it.

The microscopic examination revealed the fact that a considerable quantity of carbonate of lime was contained in most of the specimens, the fresh stone containing the most; and that in all the decayed crusts the lime was present in very small quantities only, or not at all; and in many cases this decomposition has gone on to some extent, even to the depth of eight or ten inches in the interior of the stone, without showing any trace of decomposition on the outside. The stone was thus rendered extremely porous by this solution, even where the weathered exterior retained the smooth surface of the original dressing. It therefore was porous in the interior as well as on the surface, and was subject to decomposition in all its parts. This is shown to take place far into the interior, even when it appeared not to be affected on the outside at all. I was not able to find a single specimen of the stone in any part of the building that had not apparently undergone this action to a certain extent. In some few cases the pitting is owing to the dissolving out of a small amount of the oxide of iron, which serves the purpose of an additional cement; but it is generally the carbonate of lime which has been removed.

In every case—and but few such were noticed—where the stone has been set upon its edge, the lamination has gone on to a considerable extent; but, what is more remarkable than this, is the fact that all of this stone in every part has undergone more or less of this interior decay, which seems to extend through the whole stone, and in some places where it was particularly weak has caused the bulging of the face in thin laminæ, even where the stone has been laid in its quarry-bed. In a very few instances it seems that this bulging may have been owing to a decomposition of some of the minerals contained in the stone.

None of the causes which are usually alleged to account for decay seem to be prevalent here. These are usually a loose consolidation of the sand of the stone, owing to the fact that the cementing material is not quartz, as it is in the Potsdam sandstone used in the new building of Columbia College, but is some material subject to decomposition. The true cause of the decay seems to be the fact that, owing to the defect of the undercutting of the moldings where there is a drip, the water remains in and is absorbed by the stone, and in some cases passes through it. Every shower of rain, particularly in cities, removes a very minute amount of binding material from the outside. When the stone is soft, owing to the small quantity of binding material contained in it, the action is comparatively rapid; and if to natural causes are added the corrosive gases of the city, decay will be very rapid. This decomposition goes on most rapidly under projecting horizontal pieces. The flow of rain-water over a vertical section of stone injures it but slightly, only that which is absorbed effecting any damage. The rest is so rapidly shed that it has no time to dissolve out anything. When the water is rapidly shed, the solution of the binding material is uniformly slight, as the evaporation of the water leaves all the solid parts which it may have dissolved, behind. But when the water passes through the stone, or the quantity dripping on it is such that the stone cannot absorb it, so that it either passes directly through or runs off from the surface in more or less of a stream, then the quantity actually dissolved out will always be a maximum. It is to be remarked that the places where decay exists are precisely in these conditions. In the country this would probably have but little effect, and the building would last a long time; but in the city air, which is charged with a larger quantity of carbonic acid than is usual in country air, and also with small quantities of sulphurous and sulphuric acids, and with all the acid gases that result from the decomposition of city refuse, which are absorbed by the water, it has the power of dissolving the cement of the stone even though in minute quantities, and, after a considerable period, renders the stone so loose that after a time it will flake and fall to powder, or become disfigured. As soon as this state of things was suspected, a careful chemical examination was made of five of the stones of the church taken at random, selecting, however, one, No. 1, which was fresh stone.

The analyses of these stones is given below. They show that in the weathered specimen a large quantity of the binding material has been dissolved out, leaving the stone in a condition to be acted upon by all the decomposing agencies of the weather, as frost, expansion from heat, expansion from cold, and the tendency which decay always has to spread when it has once begun.

	No. 1.*	No. 2.	No. 7.	No. 10.	No. 21.
	Fresh unexposed stone.	Weathered. Outside of No. 1	North side tower base and buttresses.	South side between 6th and 7th buttresses.	South side base between 4th and 5th buttresses.
	Interior		Scales.	Scales.	Scales.
Insoluble	90.30	91.64	96.09	95.82	94.27
		Soluble.			
Iron oxide	2.25	2.66	2.32	2.39	1.07
Lime	3.61	2.45	0.26	0.14	1.51
Magnesia	0.30	0.36	0.28	0.27	0.20
Carbonic acid, organic matter, etc	3.54	2.89	1.05	1.38	2.05

In all of these stones there is a small amount of organic matter which gives a peculiar smell when burned. In many of them no trace of effervescence with acetic acid could be seen under the microscope, and after careful drying in an air-bath the total amount of soluble material did not exceed three per cent.

*A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

* These analyses were made by J. B. Mackintosh, E. M., of the School of Mines.

The examination shows that there is no cause of decomposition in the stone itself; that the decomposition has gone on in all parts where the stone has been exposed to the air, whether inside or outside, with regularity; that most of the stone in the interior, or at a certain distance removed from the surface, is in about the same condition in which it was in the quarry; that the mere action of moisture, or of the air, affects the stone very slightly when there is only a vertical wall to be acted on. The decay of the stone is, therefore, owing to causes which act from the outside entirely, and it remains now to consider what will be the best method of adding something from the outside of the church which will prevent further attack upon and consequent decomposition of the stone. This is a matter of great importance, for, until the flaking of the stone, it was always supposed that the stone of this church would not decompose. The greatest care was thought to have been taken in its selection, but the investigation shows that the solution of the ingredients of the stone of one of the best buildings of the country, from the outside, has gone on to such an extent as to cause the stone to decay very perceptibly in less than forty years.* I am glad to be able to call attention to the probable solution of the problem, which, if not soon solved, will make most of the handsome edifices of New York ruins in the course of a few years.

The methods for the preservation of stone are, first, properly inclined surfaces that will shed the water so that it cannot stand on the surface; properly undercut moldings, so that the water cannot creep up under and remain so long as to dissolve out the binding material; keeping out the water as far as practicable. This must be done by water-proofing, so to speak, the foundations; placing a thin layer of asphalt between the foundation-stones and the vertical walls of the building proper, two or three feet above the ground. This would prevent the slightly acid waters from the earth rising and decomposing the lower tiers of stones. Asphalting the fronts of the foundation-walls themselves, previous to throwing the earth back against them, would prevent the entrance of a considerable amount of water, so that if the face of the foundation next the soil and its top were asphalted, the water would not enter here.

If the stone has been already acted on, and is to be preserved, something must be added to the outside to fill up the pores formed by the solution of the binding material, and prevent further encroachment of the water containing the acid gases in solution. To heat the surface of the stone, already weakened by decay, is only to make the decomposed surface more liable to flake. It must, therefore, be applied to the cold stone. Anything that forms a gum that is impervious to water, and can be made sufficiently liquid to penetrate the pores and pittings of the stone, will answer the purpose. Bees-wax or rosin dissolved in any of their solvents, with or without oil, have been used. Boiled linseed oil, which forms a gum, does very well, and only slightly discolors the stone for a time. But all of these substances decompose after a few years, and must be renewed. Paraffine dissolved in boiled oil, and put on hot, answers better, as it is more effectual, and after one or two applications will fill the pores completely. But no substance applied after decay has begun is equal to a preventive, and no preventive can preserve flat surfaces and projecting moldings which are not undercut, from decay. Water-glass associated with a bituminous substance, a preparation known as Szerelmy's compound, was used on some of the interior courts of the Houses of Parliament some years ago. I inspected all of these courts in the summer of 1884. The dilapidated condition not only of the finials, but even of the flat surfaces of the stone, showed that it had not even been a palliative.

About the year 1868, the Vielle Montagne Co., of Liege, introduced the process of painting with water-glass and oxide of zinc. This was applied to the railroad station at Liege, and to parts of the Houses of Parliament. A silicate of zinc and lime is thus formed on the outside of the stone, which indurates it superficially. The want of penetration, or careless application of the material, makes the surface flake, and it, like all other paints, requires frequent repetition.

Ransome's process, which consists of using water-glass, with a subsequent application of some chloride, answers very well, but is a very expensive process, as it requires that the stone should be entirely refaced, in order to clean it. This, and the number of applications of the silicate, and subsequent application of the chloride, consumes so much time, and is so expensive, that it cannot come into general use. It has been applied satisfactorily to some small parts of the Houses of Parliament, but has been discontinued on account of its very great cost. The same is true of a number of other processes, which require first, the cleaning of the stone, and the subsequent application of several chemical substances, such, for instance, as the process of the Silicate Paint Co. They are excellent in themselves; they can be put on with certainty, when used with great care, and over small surfaces; but when they are to be applied to buildings already constructed, they either fail from the impossibility of applying them evenly on large surfaces, or become entirely impracticable on account of the expense. The principle of most of these processes is correct, and it is to be hoped that some corporation will find it to their advantage to have investigations made that will lead to the discovery of some substance which is both cheap and of easy application. Such substances undoubtedly exist, but they require to be sought for. Any process which requires the formation of a chemical union between the stone and the substance applied, must be put on in such a way as both to be certain of its penetration, so that the action will not be superficial, and to insure that the compound formed will not only become sufficiently indurated to withstand the weather, but sufficiently compact not only to resist the penetration of gas, but also to prevent the absorption of moisture, and to shed it at once from its surface. Very few natural stones even do this, and they are the very compact siliceous stones, or dense carbonates, which are very homogeneous.

When oils, with or without paraffine and sulphur, are used for water-proofing stone, they should always be applied while hot, as they are then much more liquid, and, consequently, more effectual. It is better also that the application should be made when the stone is also warmed by the heat of the sun—that is, either in the spring, summer or fall, rather than in the winter. This application of oil, however is not permanent in its effects. The oil forms a gum in the pores of the stone, filling them up temporarily, so that the water does not enter, but after a time this decomposes, and must be replaced. It is very easy to distinguish the surfaces of stones that have been treated with oil, by observing them immediately after a shower, when it will be seen that the stone becomes dry much more rapidly than that which has had no such application. The necessity of applying the oil once in every two or three years is one reason why it is so little used. When paint is used, the solid material with the oil is of no account whatever. It remains on the outside, and does not enter the pores of the stone, and when the gum is decomposed it is washed off the surface. Another objection to painting the stone is, that while adding considerably to the expense of the process for protecting the stone, it adds nothing whatever to the efficiency of the oil, and it is very apt to fill up the fine tracery that may be upon the surface of the stone. It is, therefore, entirely unnecessary, and in some cases may be injurious, as preventing the penetration of the material which is designed to water-proof the stone. When oil is heated with an excess of sulphur it dissolves about thirteen per cent. of it. More of it will dissolve in hot oil, but the sulphur crystallizes out upon cooling, and when there is a large excess of it, a partial decomposition takes place, and sulphureted hydrogen is formed. The oil, with the proper amount of sulphur, becomes thick and dark like molasses, but when heated is quite thin. When the stone is coated with this material it penetrates below the surface, and as the sulphur is simply in solution, when the gum of the oil decomposes it leaves the sulphur still in the pores. Two or three applications of such a material as this would prevent any further decomposition. It has been found by experiments made on the Houses of Parliament that sulphur applied in some such way has been the only thing that has arrested decomposition in that soft, porous stone; but even this preparation has not prevented the flaking of the surface of the stone after an exposure of about twenty years, probably because it was not applied hot, and was put on when the stone was moist, or when the weather was cold.

If 20 per cent. of paraffine be added to oil containing the sulphur in solution it thickens when cold into a semi-solid buttery mass, but is fluid when hot. Such a preparation as this, applied hot to the stone, gives another element to the sulphur, which does not decompose, to fill the pores of the stone. There may be cases in which it is undesirable and inconvenient to use sulphur, and in these cases twenty per cent. of paraffine mixed with hot oil may be used. The same is true of this as of the other preparation mentioned. The paraffine, which is, like the sulphur, practically indestructible, remains in the pores of the stone after the decomposition of the organic matter of the oil has taken place, and one or two coatings of such material as this will water-proof the stone entirely and prevent further disintegration. Other preparations of paraffine may be used to advantage, but those which involve heating the surface of the stone should be avoided. It has been suggested that these preparations discolor the stone. It is true that the color of the stone is darkened by them, but the stone is not disfigured, as the color given is very nearly uniform over the whole surface. In some cases the stones, after the application of the oil, have been washed with ammonia salts to take off the excess of the material from the surface. It is generally, however, undesirable to do anything to the stone after the liquid has been applied, as the surface will very soon become bleached by the action of the weather.

It has been objected to the use of oils that they would interfere with the adhesion of the mortar in the stone, if the stone were treated before it was put into the building. In actual practice, however, this does not seem to be the case. The stone is not only more thoroughly protected from moisture upon all sides, for in stone buildings in damp countries the moisture is as much to be feared on the inside as on the outside, but it does not seem in any way to deleteriously affect the binding power of the mortar. It acts advantageously both on the stone and the mortar, and does not influence any of the chemical changes that take place, either by accelerating, retarding, or preventing them. This fact was well known to the ancients, for they used oil in mortars and cements to a considerable extent. When it is desirable to use soft and very porous stones for building purposes, the stone should be dipped either into boiling oil or some such preparation as this, before being put into the building, so that its entire surface may be coated. The experience of the last thirty years shows that the stone cannot be perfectly protected unless this is done on all sides of the stone. Such coating does not in any way prevent the adhesion of the mortar if done either before or after it is put into the building.

In the experiments made in the year 1861, I was successful in preventing the further decay of a building which has, up to this time, shown no sign of lamination or disintegration. This was done by the use of thoroughly boiled oil alone, applied with a brush during the warmest of our summer weather, when the stone was very hot. It was done twice at intervals of several years, and completely arrested the decay for the time being. It would have been much more effectual if the preparations mentioned above had been used. The application of such material does not change the surface of the stone. It was used almost exclusively to porous sandstones. It seems to form a sort of cement, similar to the organic binding material which is so common in many of the brown sandstones, but with the limestones this has not been found useful to any extent. It requires renewal so often, and changes the color of the stone so unpleasantly, that it has not been found of service with these stones. Such preparations are, however, of no use on stones of whatever character, where the decay has been produced by disintegration caused by the unequal expansion and contraction of the minerals forming the stone. Such disintegration is very slow in most stones. It has taken thousands of years to produce it in the granites of the obelisks of hot countries. It appears to be more rapid in cold ones; but it takes place with unerring certainty and regularity in all those rocks where the minerals composing them have different rates of expansion and contraction. Here, as in the other case, there are cavities, but the filling of them does not arrest the decay, because it does not attack the cause. Nothing will arrest such decay, and no other decay in stone, except those caused by the air and water, can be prevented by any application to its outside. It is therefore useless to attempt the preservation of such rocks as granite, since the unequal expansion of the minerals which compose the rock cannot be arrested by filling the cracks. They are applicable only to stones from which something has been dissolved out, leaving cavities which can be filled from the outside. Water-proofing the surface of a stone has the effect of keeping the water out of pores that allow some of the constituents of the stone to be attacked, and is effectual in those stones only which are either porous by nature, or have become so by the solution of parts of their ingredients; but it has absolutely no effect where there is any movement in the particles which compose the stone, however this movement may be produced.

No method of protecting the surface of the stone of the Houses of Parliament has, so far, been successful, except where sulphur was dissolved and added to the outside of the stone, and this rendered the stone for a very long time water-proof. It had remained so for twenty years up to August, 1884, when I examined it, and found that it had begun to laminate, the part of the stone containing the sulphur peeling off in thin scales. The experience of the repairs at the House of Commons is that most of the substances which are supposed to be useful, are absolutely useless, if not positively harmful to that stone; that almost the only one that has been successful at all on these stones has been sulphur dissolved in some compound, and applied to the stone so that the sulphur itself was precipitated in its pores. But even this does not seem to have entered very far, and has not been successful unless the stones put in place of those removed had been treated on all their six sides. In that case the stone has been preserved, but how long it will remain so it is impossible to tell.

With dolomite, in which there is a large excess of lime, the only safety is to prevent the action of the carbonic acid contained in the air by water-proofing the outside of the stone. This can be less successfully accomplished, because, as the surfaces of attack are comparatively large, the action is from the outside, and but little pitting takes place, as the interlacing of the crystals makes cavities that never can penetrate far into the stone. Any coating applied to the outside will therefore be likely to wear off after a time, and thus leave fresh surfaces of attack, which do not at once become visible, as the surface is constantly kept clean by the rain and the wind.

All the experiments made in Europe with the use of silicate of soda, or water-glass, upon any building stones, except those in which lime and magnesia were principal elements, have met with signal failure. The use of water-glass or siliceous material amounts to nothing on siliceous rocks. The silica becomes decomposed by exposure to the air, and forms a sand which drops off, and the caustic alkali is washed out, or remains behind to help the disintegration. The only things which have been successful have been those that prevented the attack of the acid gases or water from the surface or sides of the stone.

Water-proofing is best done by a compound of paraffine, sulphur, and oil, applied to the stones before they are put into the building, or else frequently applied to the surface after they are put in. In sandstones the sulphur is not necessary. Oil, with a certain amount of paraffine, may be used, providing the application is made hot. If however, it is made cold, the preserving material sinks but a little way into the stone. If the stone is heated from the outside, with the intent to bring the surface of the stone up to such a point that it will heat the paraffine, there is great danger that the stone will suffer more from the remedy than from the disease.

There is no necessity for the decomposition of brownstone if the material is carefully selected. Every building that I have examined contains some stones that would last indefinitely, and if only those were selected from the quarry which have a siliceous cement, there would be no necessity for water-proofing, and we should not have the rapid destruction in beautiful structures which is so common in countries where sandstones are used. The same kind of external water-proofing must also be done upon dolomite and limestone, but efforts in this direction have been less

*All the decayed surfaces of the stone of Trinity Church were re-cut in the summer of 1884.

successful than upon sandstones. Many methods for the prevention of disintegration have been tried, not only with no success, but with absolute failure.

[This concludes this paper. The discussion on it will be published in subsequent issues.]

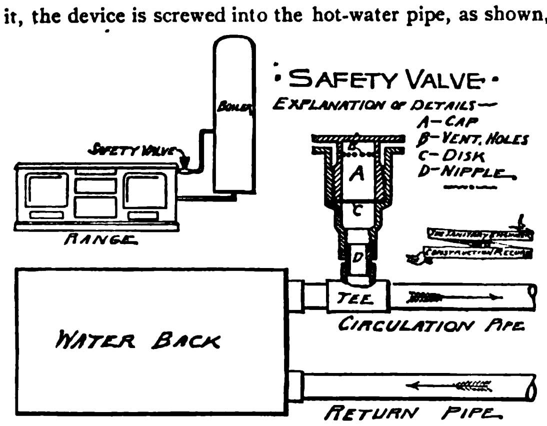
DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

ERRATUM.

IN the "Thermus" article, in last issue, page 487, second paragraph from bottom of second column, an oversight in correcting proof made it read: "It is found (local circulation) in the boiler on the outer sides in the diagram (*sic*) *at b*, by the direction of the arrows." It should read "*Fig* 3, by the direction of the arrows."

SAFETY-VALVE FOR WATER-BACKS.

A RECENT communication to the *American Architect*, describing a device to attach to hot-water pipes to prevent water-back explosions, used in Montreal, attracted our attention. We wrote to a correspondent there for fuller details, and the following drawing has been made from the description we have received. As we understand it, the device is screwed into the hot-water pipe, as shown,



between the range and the hot-water boiler. In the words of our correspondent, "It is to be put as close to the water-back as possible, by being screwed into a *tee* left for the purpose, and the weak spot is provided for in the shape of a piece of sheet lead or soft composition metal," shown in the inclosed sketch.

We do not say that this will prove absolutely worthless as a vent in all cases of frozen water-backs, but in a great many of them it must, and under no circumstances could we advise implicit confidence and dependence in its use. As a safety-vent of pressure only it is easy to see how the lead will bend and leak when a water or steam pressure sufficiently great is brought to bear on it, but with the circulating-pipes frozen and a plug of ice in the nipple D, we cannot see what protection it will be if a fire is started in the range.

Water-backs break under two or more conditions of pressure: (1) an ice-pressure when the ice is forming; (2) a water-pressure when the inclosed ice is thawed by fire and expanded to a greater bulk than it occupied when frozen; and (3) a steam pressure. The first is only dangerous to the water-back itself, but the other two endanger the life and limb of any one that starts a fire within the range. When a water-back is frozen it is not only reasonable to assume the circulating-pipes are also frozen, but we are bound to consider them frozen, as being outside the stove they freeze first and thaw last. A fire when started thaws the ice, which at first decreases in bulk, allowing the strained sides of the back to return to flat position.

As the water warms to 40° Fah. it still shrinks, but when it passes this temperature it begins to expand again. If the rupture will take place before the water reaches a temperature of 212° Fah., no harm will be done, as then only a gallon of hot water is spilled; but this may be said to never take place, as the back that has been elastic enough to spring and not crack under the expansion of frozen water will not crack under the increase of bulk of water between the temperatures of 40° and 212°, as the increase of bulk for ice is greater. It therefore follows that the temperature and pressure of the water within the back goes on increasing until its bulk is as great as when it was ice, before the point of rupture can be reached, and then it will be found by a little calculation that the pressure within the back is not far from 200 pounds per square inch, and, presumably, it may go on until it is 400 pounds per square inch, with a temperature of about 450° Fah., when it gives way suddenly at a time that the expansive force of the liberated water and steam is capable of projecting a broken casting almost with the force of powder.

If the thawing done by the heat of the fire should commence at the safety-valve, or if the heat follows the pipe outward sufficient to thaw the connections before a dangerous pressure is reached, then the steam escapes and there is no explosion; but in the case of long connections, where they have to pass through, or behind, or over, the chances are too great to take.

This question is not properly solved as yet by any device we have seen to take the place of extreme care in starting a fire.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

LONDON, March, 1887.

SIR: As a teacher of plumbers' work, and having had some experience of examinations, I have read with great interest the questions and answers of the "Plumbing Catechism of the New York Trade Schools." As criticism is invited, I feel constrained to offer mine, more with the wish of exchanging ideas than to appear to be finding fault with an institution that is doing so much real good as the one above mentioned. As a preliminary, I beg to say that I think the questions are too leading. An examination of plumbers should be conducted so as to bring out their knowledge without any prompting. I do not intend in this letter to go through the whole of the questions, but only to take a few here and there which I think should be amended.

6. Question 6 claims my first notice. This I think would be better thus: "What is meant by corrosion of metals?" "*Describe* the various actions which cause this." This would test the student's knowledge of galvanic action, and also the action of water, air, gases, and acids on the metals.

7 and 8. They should be connected thus: "*Describe* how cast-iron pipe is usually prepared, before using, to prevent corrosion." The student should then describe the process, and not evade it, as given in the answer to No. 8.

NOTE.—It is useful to know this process, as small fittings, such as bends, T's, etc., can be coated, when required, in the workshop.

9 to 16. These should be: "Sketch a length of cast-iron soil-pipe, figure in all the dimensions of the kind you would prefer to use, and state why you would prefer to use it."

17, 18 and 19. These should be: "How would you examine and test a pipe before fixing it, and what defects would you more particularly look for?"

28. The answer is misleading and incomplete, as rust cement will not rust thoroughly in a joint on coated pipes, which is inferred.

29 to 50. These questions are good, but some could be bracketed together and the student asked to *describe* the details.

SERIES NO. 2—THE TRAPPING AND VENTILATION OF SOIL-PIPES.

3 and 4. These questions are too leading. Should be: "Will water in a trap prevent sewage-gases from passing through, and if so, how?"

10. To the answer should be added: "Large and sudden water discharges into badly-ventilated sewers will displace some of the air, which will sometimes burst through the traps in the house-drains. When the water in the sewer subsides a partial vacuum is made, and air rushing through the traps to fill the vacuum will push some of the water out of the traps and leave them unsealed."

12. The answer is very vague.

14 and 15. These should be connected. The answer to No. 14 is misleading, and depth of seal should be described.

17. The answer should be: "The distance the bridging or dip is immersed in the water."

20. The question is incorrectly put and the answer does not apply to the question. Momentum of a column of water through a running trap will sometimes unseal it and vacuum has nothing to do with it.

21. The question should be: "What is the effect *on a trap* of a column of water passing through and completely filling the pipe leading from the trap?"

31. "This ventilating-pipe" should be read, "the air-inlet pipe."

36. The answer does not state why it cannot be made self-cleansing.

40. Some authorities say *sewer-gas* is a misnomer.

41. Should be added: "Or by placing the trap where the water would not be liable to evaporate."

COLD-WATER SUPPLY.

1. The student should give an example of an imaginary house.

7. Advantages not answered: Water cannot get between tin lining and lead pipe when the pipe is properly made. Perhaps this question is not intended to apply to this kind of pipe.

28. There might be added "or by fixing a 'differential valve,' so arranged as to reduce the pressure."

REMARKS.—Taking the questions as a whole, they are good, but would be better if several would be bracketed and worded rather differently, so as not to prompt the answers. As I have here given my opinion of the questions published up to date, I shall take it as a favor if some one will criticise those I now send you, and which I have used at my own plumbing class at the Polytechnic.

Yours truly, J. W. CLARKE.

[The questions used by Mr. Clarke at the Plumbing class at the Polytechnic Young Men's Christian Institute we shall publish in a later issue.—ED.]

EXAMINATION OF PLUMBERS IN CALIFORNIA.

25 STOCKTON STREET,
SAN FRANCISCO, CAL., March 31, 1887.

SIR: As the Master Plumbers of San Francisco have had an amendment to the sanitary laws of California passed by late legislature, which compels all plumbers to be licensed by the Board of Health, we are drawing up a set of questions to be asked of applicants for license. Would you be kind enough to furnish me with the questions asked of plumbers by the License Committees of New York and Brooklyn, and any other suggestions you would like to make? By so doing you will confer a favor on,

Yours truly, WILLIAM F. WILSON.

[We trust the members of the License Committees referred to will communicate the information to their brethren in San Francisco in response to the request of our correspondent. So far as we are aware, there has hitherto been no examination of plumbers by the Boards of Health of either New York or Brooklyn, but the Department of Public Works of this city did at one time require applicants for license to make water and sewer connections to appear before a Committee of Master Plumbers.]

THE master and journeymen plumbers' associations of San Francisco have united to prepare a list of questions for the examination of applicants for license as practicing plumbers. The questions will be submitted to the Board of Health, and a plan for conducting the examinations will be soon adopted.

THE Cleveland, O., Master Plumbers' Association, recently reorganized with the following officers: President, George S. Paine; First Vice-President, Adam Schneider; Second Vice-President, Louis Poplewsky; Secretary, A. Daykin; Treasurer, Charles Dewstoe; Seargeant-at-Arms, John Nixon. The majority of the master plumbers have joined the association.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

RISK OF DISPOSING HOSPITAL SEWAGE ON LAND.

POTTSVILLE, PA., April 5, 1887.

SIR: Please let me know how vats for receipt of latrine disposals are constructed. What would be the danger, if any, coming from sick ward connected with an almshouse for use of the deposit on land for manuring purposes?

Yours respectfully, HENRY R. FOSTER.

[The danger in using sewage from a hospital ward for surface irrigation would be somewhat greater than for ordinary sewage, inasmuch as it would be more likely to contain specific germs, such as the bacillus of typhoid, etc. If the sewage is disposed of by subsurface irrigation there would be no special danger connected with hospital sewage. In any case the danger is probably not great.]

SEWERAGE-SYPHON AT NORFOLK, VA.

NEW YORK, April 8, 1887.

SIR: The illustrated article on page 486 describing sewerage syphon at Norfolk, Va., designed by Colonel George E. Waring, is very interesting, and sets forth a most ingenious and practical method of surmounting the difficulty.

It would be interesting to know in this connection what is the difference in elevation between the summit of this syphon and its inlet, or, in other words, how high the sewage is lifted above the surface of water in the 5-foot intake-well. We understand, of course, that there is a limit beyond which sewage or clean water cannot be lifted by atmospheric pressure, and the nearer to that limit reached by the present instance the more interesting it becomes.

Very truly yours, WILLIAM HENRY BALDWIN.

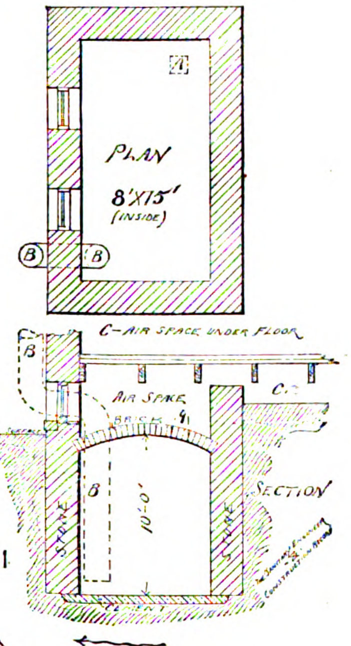
VENTILATING A VAULT.

WASHINGTON, D. C., April 1, 1887.

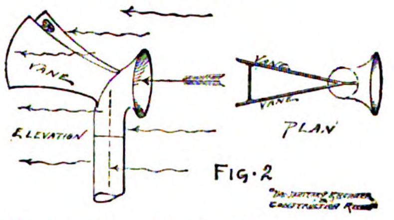
SIR: If you will kindly answer the following without much trouble to yourself, I should be very glad to have you do so through the columns of THE SANITARY ENGINEER AND CONSTRUCTION RECORD. I cannot ask you to consider it at length, but would like a brief explanation. I found the problem the other day in a country house near here and wondered if it could have any simple, inexpensive solution.

A storage-vault 8'x15' and 10' deep, below ground surface, with no opening when the door is closed, except a 1-foot square hole in the brick arched roof, opening into an air-chamber 3 or 4 feet high over the whole vault, the latter having two windows to open air. How can the vault be sufficiently ventilated in a cheap way? Would a duct B (Fig. 1) from the side of the house above the windows to near the bottom, convey any air? Very truly yours, D.

[Without some mechanical power, or its equivalent *in heat*, you cannot move air enough to give satisfactory results. You want, if possible, to dry the air, lessen its humidity, and cleanse it sufficient to prevent the growth of fungus. Cold air in a hole beneath the ground is just like water in a hole in one respect. It is heavier than the surrounding and superimposed atmosphere and must be pumped out; in other words, every pound of it that is lifted will represent work done.



FIG·1



FIG·2

Above the ground-level it also takes power to move air, but generally the air is warmer than the outside atmosphere, and thus the draught in chimneys, etc., goes on, as the pressure outside is greater, but in the case of the vault there is light, warm air above it that cannot descend to press the cold and heavy air out, and there it will stay unless forced or drawn out, which means the same thing.

If you can connect the pipe B, which you propose, to a warm chimney, it will draw the air out from the bottom, admitting fresh air at A. But as you show it, against the wall of the house, it will do no good unless the sun shines against it all the time.

If there is no warm flue in the house to spare, put a little heat—steam-coil—into B above the vault, or so that it will not warm the vault, and that will do. If you can tap a fan or air-pipe, which we presume improbable, a small inlet four to six inches will do, near the floor. Then, if you can take advantage of prevailing winds, make a cowl C with a large vane that will always hold it into the wind; when placed on B it will do for a great part of the time if you extend the duct above the house-top. The double vane will keep the cowl from swinging about.]

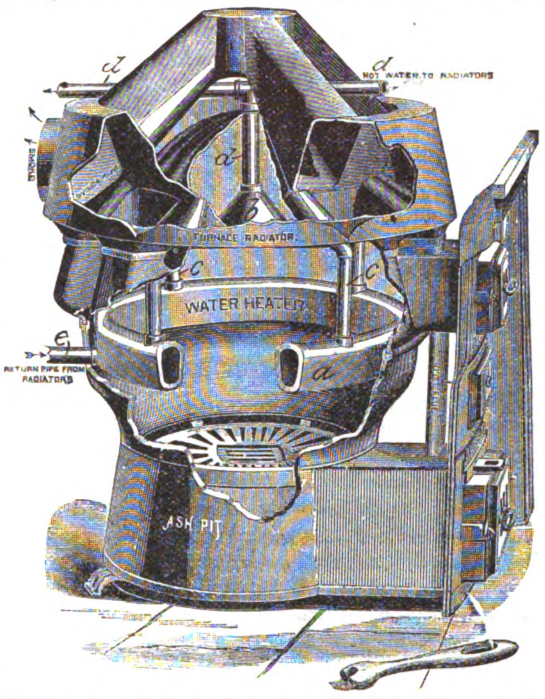
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval*. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

COMBINED AIR-FURNACE AND HOT-WATER APPARATUS.

THE accompanying illustration shows the MacKay system of furnace and hot-water apparatus combined for the warming of dwellings, etc., and just about to be introduced by the Denny Bros. Company, of 34 Park Place, New York.

It consists of a suitable hot-air furnace, within which is arranged the annular hot-water ring *a*, which is cut out at



the side to show the water-space. This ring is connected with a hollow cone or crown *b* by the four vertical pipes *c c*, from the top of which extends the flow-pipe *d*, which runs to the system of radiators or coils in the manner peculiar to any hot-water apparatus. At *e* the steam flow-pipe enters the boiler again, completing the circulation.

It is claimed for it that the water in the ring and cone seizes on a large part of the heat of the fire and prevents overheating of the surface of the furnace; that a greater amount of the heat is utilized, as much of what ordinarily would go up the chimney is utilized in heating water; that rooms at a long distance from the furnace, and to which air could not ordinarily be carried, can be warmed by the water radiators; and furthermore, that there is an advantage of having both warm-air supply for ventilation and direct hot-water radiation in the same room. Its further use is manifest to all heating engineers.

ASHES AND GARBAGE REMOVAL IN NEW YORK.

THE New York City Board of Health, acting on the request of Street Commissioner Coleman for the better regulation of the manner in which householders should get their garbage receptacles ready for collection by the carts of the Street-Cleaning Department, has adopted a resolution amending the Sanitary Code; so that the sections relating to garbage will hereafter read as follows:

Section 95. That it shall be the duty of every owner, tenant, lessee and occupant of any and every building, or place of business in the generally built-up portions of the city of New York, forthwith to provide, or cause to be provided, and at all times thereafter to keep and cause to be kept and provided, within such building or place of business, suitable and sufficient boxes, barrels or tubs for receiving and holding without leakage, and without being filled to within four inches of the top thereof all the ashes, rubbish, garbage and liquid substances of whatever kind, that may accumulate during thirty-six hours, from said building or place of business, or the portion thereof of which such person may be the owner, tenant, lessee or occupant; and every such box, barrel, and tub designed to hold ashes shall be made of or lined with some suitable metal. That a separate vessel shall be provided for ashes and rubbish, and another for garbage and liquid substances; and ashes and rubbish shall not be placed or kept in the same vessel with garbage and liquid substances; and all ashes, rubbish, garbage and liquid substances that should be removed from such buildings and place of business, or from that part for which said receptacles were provided, and none other (without the proper consent), shall be placed therein, and no such box, barrel, or tub, before or after it is emptied, shall be placed or permitted to remain upon the sidewalk, or in any other public place, but shall be kept within or upon the premises of the person or persons to whom it belongs, until removed therefrom for emptying by the authorized employees of the Department of Street-Cleaning, and by them returned to the place whence it was taken.

Section 96. That such boxes, tubs, or barrels shall be placed or kept at all times in such places as to be readily accessible for removal for emptying, and where they shall not be a public nuisance; and no person, not for that purpose authorized, shall interfere therewith, or with the contents thereof.

[A similar requirement was made of householders once before, but those who provided separate receptacles for ashes and garbage found that the Street-Cleaning Department's cartmen dumped the contents of the separate cans into one and the same cart. Whereupon these citizens very logically concluded that one receptacle was quite enough—under the circumstances. Commissioner Coleman must therefore look after his cartmen if he wishes this ordinance to be complied with.—ED.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
April 9.	26 90	20 99	21.04	30.06	29.43	25.36	32 11

E. G. LOVE, Ph.D., *Gas Examiner.*

OTTO GAS-ENGINE INFRINGEMENTS.

THE Gas-motoren-fabrik Deutz, of Deutz, Germany, who own the "Otto" patents in Germany, have just obtained a decision in their favor in their suit against Moritz Hille, of Dresden, a manufacturer, and several of his clients and users of infringing engines. The decision establishes the infringement by the defendants, and orders them to discontinue the manufacture and use of the machines; also to account for damages. The Hille engine used the well-known Otto four-stroke cycle, and it is against its use that also other suits still pending against Körting Bros. and Buss, Sombart & Co. are directed.

EXPERIMENTING WITH A COMPOSITE PAVEMENT IN PARIS.

A CORRESPONDENT in a letter to *Le Genie Civil*, calls attention to a composite pavement laid by an American syndicate on the Rue de Rivoli in Paris, which he states in eight days after it was open to traffic began to break up. It seems that this pavement was laid on the Rue de Rivoli, where the traffic amounts to 33,000 vehicles per twenty-four hours, and the contractors, who had agreed to keep it in repair for two years, failed to take into account this unusual amount of traffic. Hence they are relaying the pavement with greatest care to meet these extreme conditions. Another year's trial will doubtless demonstrate whether this kind of pavement will be suitable for such heavy traffic.

THE COMPETITION FOR PLANS OF THE JEFFERSON COUNTY, ALA., COURT-HOUSE.

THE commissioners of Jefferson County, Ala., and the Probate Judge recently gave notice that they would receive plans in competition for the design of the new court-house of that county. The architects of Birmingham, who had recently formed the Alabama Association of Architects, sent to the commissioners a request that the competition be conducted in accordance with certain conditions named by the association, which were substantially those proposed by the Western Association of Architects. The commissioners declined to accept this suggestion, practically refusing everything, except that they would return the plans when they had no further use for them. The association then voted that all its members should refrain from taking any part in the competition. Resolutions were passed as follows:

"*Whereas*, It has appeared through the papers of Birmingham, Ala., that the Probate Judge and County Commissioners were desiring to receive plans, drawings, etc.,

for a new court-house for Jefferson County, and that many of the architects belonging to the State Association being desirous to make and compete with plans for said court-house, met in conference and formulated certain rules, which were unanimously adopted, and by which all plans were to be submitted, and in due consideration of all the rights and powers delegated to said commissioners and Probate Judge, the association appointed a committee belonging to the State Association, to confer with said officers as to the propriety of having such rules and regulations adopted and carried out, in the acceptation of plans, all of which were rejected by the said court; now, be it

"*Resolved*, By the association, that we receive this rejection as a mark of contempt as to our wants or our work.

"Secondly, it is resolved by this association that we, as members of the State Association of Architects of Alabama, pledge ourselves to abstain from competing in the matter, believing that the pledges given the committee as to the conduct of the competition to be insufficient.

"Thirdly, be it further resolved, that any architect belonging to this association who shall submit plans for the said court, or have any connection in the matter in any shape, shall be considered unworthy of membership of the association."

THE NEW HARLEM RIVER BRIDGE.

THE work on this important structure is progressing rapidly, and all the difficulties attending the foundations have been successfully overcome. The foundations of all the small piers and the main pier on the New York shore are in place, and the masonry of the latter has been nearly completed to the springing line of the arch. Main pier No. 2 is on the edge of the Westchester shore. Here a caisson 54x104 feet has been successfully sunk by the contractors, Messrs. Anderson & Barr, to a depth of 40 feet; and it is anticipated that the concrete filling will be completed within the next 10 days. The work has been somewhat tedious on account of the large amount of rock to be blasted to obtain a level foundation. The limit of the work that could be done was found to be fixed by the ability to remove the rock from the caisson, and not by the amount that could be drilled and blasted. The lighting of the caisson by electricity is a vast improvement over the use of candles or gas. The compressors used are of the A. K. Rider patent, manufactured at the Delamater works. A Clayton compressor is used for blacksmith fires on top.

The caisson itself it very simple in construction, having outer walls of timber about 8 feet high and 3 feet thick, the lower 3 feet being chamfered on the inside to a narrow edge. The inner and outer courses are horizontal, and the intermediate one vertical. The roof is of a number of courses of timber, and the space underneath is divided into three chambers by longitudinal walls of timber 2 feet thick. The whole is ceiled by double thicknesses of matched inch boards, made tight by white lead.

The material was removed by means of an iron shaft projecting into the central chamber so as to form an air-lock, and there enlarged so as to form an air-lock of sufficient size to contain six iron buckets into which the material was shoveled. These were hoisted through the shaft by a derrick above.

Pier III., 550 feet centre to centre from Pier II., has the masonry nearly ready for the skew-backs of the main arches

This pier was the one which caused the greatest amount of discussion among those bidding for the work. The borings at first made showed at one point that the rock was not found until a point about 50 feet below tide was reached, while at others it was considerably above tide. As a matter of fact no such depth was reached by the foundation, and it would seem that the drill must have followed a crevice in the rock. The method pursued was to remove the superficial earth down as far as practicable to slopes of about 1 to 1 and then timber the excavation regularly and work in open cut.

The general contractor for the work, Mr. Miles Tierney, has adopted what is known as the "Contractors' Derrick," having a special casting at the bottom of the mast which serves also for the support of the foot of the boom; also adopted a special concrete-mixer. We shall illustrate these in a future issue, in our series of articles on "Builders' and Contractors' Engineering and Plant."

The Chief Engineer, Mr. William R. Hutton, and his assistant, Mr. Alfred Noble, are to be congratulated on the successful results thus far reached in this important enterprise.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met April 6, at Washington University, Vice-President Holman in the chair, twenty-eight members and visitors present. S. Bent Russell read a paper on "Draining and Filling Water-Mains," describing the system of operations in use in St. Louis, where shut-offs average one per day. The difficulties met with and the precautions to be taken were treated. In the discussion Mr. Holman gave some interesting points in his experience bearing on this question.

Professor C. M. Woodward discussed the failure of the Bussey bridge on the Providence and Boston Railroad, describing fully the nature of the accident and illustrating the details by sketches on the blackboard. His explanation of the cause of the accident was full and clear. The matter was also discussed by Messrs. Seddon, Frith, Johnson, and Moore. The recent full publication, and illustrations in the *Engineering News* were favorably commented upon.

Professor Johnson announced that there would be a meeting of the Board of Managers of the Association of Engineering Societies at Chicago at an early date, and asked that suggestions as to the management of the association be made. Several topics were brought forward and discussed.

HARTFORD HEALTH REPORT.

THE second annual report of the Board of Health of Hartford, Conn., is for the year ending February 28, 1887. This estimates the population at 47,000, giving a death-rate of 19.63. This is lower than it was in 1884 or 1885, but it is still too high. Last year was, so for as climatic conditions and special epidemics are concerned, what is known as a healthy year, and the death-rate of Hartford ought not to have exceeded 17 per 1,000. There were reported during the year 94 cases of dipththeria, 38 of scarlet fever, and 22 of typhoid fever.

The board again recommends that a survey be made for the construction of a set of intercepting sewers, stating that every year increases the need, and all the work done and expense incurred in building cheap and inadequate sewers will certainly have to be looked upon as waste of both labor and money.

THE annual report of the Board of Health of the city of Reading, Pa., for 1886, indicates a satisfactory improvement in the healthfulness of the city, the total number of deaths having been lower than for any year during the last five years. The population is estimated at 52,250, which gives a death-rate of 16.4 per 1,000. The board refers to the fact that in warm weather the water from the reservoirs becomes fishy and nauseating, and remarks in a general way that benefit will ultimately accrue to the people by the adoption of a system of public sewerage. A sewage-farm is also recommended, but if the board has any plan for either sewers or sewage-farm it gives no sign. Perhaps it may be trying to break the matter gently to the municipal authorities.

DR. BICKNELL states that the sewage of Los Angeles, Cal., has been used for fertilizing purposes for fourteen years. It is carried in a main sewer for four miles, and is then distributed by irrigating ditches to several farms. This plan of disposing of the sewage was at first bitterly opposed, and the results as regards the health of the neighborhood have been closely watched, but no ill effects have been observed.—*Southern California Practitioner, March*, 1887.

THE PROPER WEIGHT OF MAN.

PROFESSOR HUXLEY asserts that the proper weight of man is 154 pounds, made up as follows: Muscles and their appurtenances, 68 pounds; skeleton, 24; skin, 10½; fat, 28; hair, 3; thoracic viscera, 3½; abdominal viscera, 11; blood which would drain from the body, 7. The heart of such a man should beat 75 times a minute, and he should breathe 15 times a minute. In 24 hours he should vitiate 1,750 cubic feet of pure air to the extent of one per cent. A man, therefore, of the weight mentioned, should have 800 cubic feet of well-ventilated space. He should throw off by the skin 18 ounces of water, 300 grains of solid matter, and 400 grains of carbonic acid, every 24 hours; and his total loss during that period would be 6 pounds of water, and a little more than 2 pounds of other matter.—*The Hospital*.

PERSONAL.

MR. GEORGE BOWERS has been appointed City Engineer of Lowell, Mass.

GEORGE B. BRAINERD, for some time connected with the Water Department of Brooklyn, died in that city on April 13, aged forty-three.

MR. BENTON J. HALL, of Iowa, entered on his duties as Commissioner of Patents on April 11.

MR. W. E. BROWN, architect, of Detroit, Mich., has been appointed superintendent of the new Government building there.

COLONEL JOHN M. WILSON, Lieutenant-Colonel Peter C. Haines and Major Garrett J. Lydecker have been appointed members of a board to meet in Washington to consider matters relating to the proposed Bennington Battle Monument.

BOSTON CHAMBER OF COMMERCE BUILDING.

MESSRS. PEABODY & STEARNS, Bradlee, Winslow & Wetherill, and John H. Sturges, of Boston, and McKim, Mead & White, of New York, have been invited to take part in a paid close competition for plans of the Chamber of Commerce Building.

ARCHITECTURAL LEAGUE OF NEW YORK.—The meeting on April 4 had an attendance of forty members, the largest yet had, the feature of the occasion being an exhibition of the sketches of Mr. Charles A. Rich, made during a trip abroad. The new form of constitution was considered, and the form agreed on it was voted should be printed, sent to each member with a proxy attached, in order to secure a vote for or against at the next regular meeting, to be held May 2. A committee reported that missing drawings loaned the League had been found at the American Art Galleries, and had since been returned to their respective owners.

GAS-STOVE COOKING.

MISS CORSON will give another lecture on "Gas-Stove Cooking" at the Metropolitan Opera-House this afternoon at 2:30 o'clock. The lectures are given under the auspices of the American Meter Company, 223 Sixth Avenue, where tickets may be obtained.

Patents.

358,037. Furnace. Werter C. Higgins, Norwich, Conn. Filed July 29, 1886. Serial No. 209,379. Issued February 22, 1887.

358,040. Filter. John W. Hyatt, Newark, N. J., assignor to the Newark Filtering Company, same place. Filed May 25, 1885. Renewed December 30, 1885. Again renewed July 31, 1886. Serial No. 209,712. Issued February 22, 1887.

358,053. Electrical Pumping Apparatus. Moses A. Michaels, Allegheny, and Albert Michaels, Pittsburg, assignors of one-fourth to John B. Sneathem, Pittsburg, Pa. Filed August 20 1886. Serial No. 211,379. Issued February 22, 1887.

358,065. Incasement for Air-Heaters. Philip J. O'Brien and William J. O'Brien, Peoria, Ill. Filed March 19, 1886. Serial No. 195,785. Issued February 22, 1887.

358,083. School-Building. James C. Stewart, Lebanon, Ind Filed March 19, 1886. Serial No. 195,798. Issued February 22, 1887.

358,089. Transom-Ventilator. John P. Tierney, Oakland, Cal. Filed October 4, 1886. Serial No. 215,329. Issued February 22, 1887.

358,106. Filtering-Machine. James A. Crocker, Boston, Mass., assignor to the Crocker Filtering Company. Filed April 16, 1886. Serial No. 199,053. Issued February 22, 1887.

358,107. Filtering-Machine. James A. Crocker, Boston Mass., assignor to the Crocker Filtering Company. Filed April 16, 1886. Serial No. 199,054. Issued February 22, 1887.

358,108. Filtering-Machine. James A. Crocker, Boston, Mass., assignor to the Crocker Filtering Company. Filed July 3, 1886. Serial No. 207,057. Issued February 22, 1887.

358,112. Water-Filter. Lorens Fjord, Alameda County, and John Broters, San Francisco, Cal. Filed September 18, 1886. Serial No. 213,960. Issued February 22, 1887.

358,123. Hot-Water Pipe or Fitting for Cooking-Stoves. John O'Keefe and Charles H. Filley, St. Louis, Mo. Filed December 30, 1885. Serial No. 137,092. Issued February 22, 1887.

358,126. Cable-Railway Structure. Charles H. Platt, New York, N. Y. Filed February 19, 1886. Serial No. 192,478. Issued February 22, 1887.

358,134. Gas-Engine. Robert Von Kalkreuth, Green Point, N. Y. Filed June 9, 1886. Serial No. 204,576. Issued February 22, 1887.

358,135. Smoke-Consumer. Hugh R. Walker Detroit, Mich. Filed August 2, 1886. Serial No. 209,733. Issued February 22, 1887.

358,147. Waste-Pipe and Valve for Basins. John Demarest, New York, N. Y., assignor to the J. L. Mott Iron-Works, same place. Filed October 2, 1886. Serial No. 215,114. Issued February 22, 1887.

Contracting News Department.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CLEVELAND INFIRMARY PLANS.

THE Board of Directors of the Infirmary Hospital, at Cleveland, O., examined plans submitted by several architects, on April 11. It was stipulated that the building must not cost more than $60,000. Plans were submitted by Messrs. Lehmann & Schmidt, John Eisenmann, F. C. Bate, George F. Hammond, and A. Koehler. They were taken under consideration.

PHILADELPHIA MASTER BUILDERS' EXCHANGE.

THE new rooms of the association were opened last week. The admission fee is $200. Full charter memberships of $100 have been taken. Fifty applications are on file. The exchange bids fair to have an important influence on the building interests of Philadelphia.

TRADE CATALOGUES.

THE Newark Filtering Company has just issued a fifty-page pamphlet entitled "Descriptive Circular of the Hyatt Pure Water System" as adapted to various uses.

Proposals.

GRANITE PAVING. Until April 21. Quantities: 10,000 lineal feet of curbstone; 1,200 lineal feet of flagstone; 150 lineal feet circular curbstone; 4,500 square yards paving-blocks; 40 large corners; 60 small corners. Address Charles A. Allen, City Engineer, Worcester, Mass.

CONTRACTING INTELLIGENCE

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.*

For works for which proposals are requested, see also the "Proposal Column," pages 511-512-524.

CONSTRUCTION.

WATER, SEWERAGE, ETC.

BROOKLYN—Commissioner Conner, of City Works, wants funds appropriated for the purchase of fifteen miles of water-mains to be laid between May 1, 1887, and May 1, 1888.

MCPHERSON, KAN.—Bonds have just been voted to extend water-works to amount of $40,000, 6 per cent. semi-annual coupons. The town has not decided on what plan to use, but the stand-pipe system seems to be the favorite. The water-supply will be drawn from wells 80 to 100 feet deep. D. C. Welsh is the City Clerk.

FERNANDINA, FLA., April 5.—The specifications for the before-mentioned water-works are now in the hands of the printer, and will soon be issued.

NEOSHO, MO.—Proposals for building water-works here will be opened on Monday, by Mr. Lee D. Bell, Mayor. The works are to have a capacity for furnishing water for 15,000 inhabitants.

CLEVELAND, O.—Proposals are advertised by Mr. John Whitelaw, Superintendent of the Water-Works, for wrought-iron water-pipe three feet in diameter. The iron to be ½-inch thick and all joints to be double-square riveted.

EASTPORT, ME.—Mr. Talcott is contractor for the works to be built this spring by the water company.

GLOUCESTER CITY, N. J.—See our Proposal Column for notice in regard to the construction of water-works here.

LANCASTER, PA.—J. J. R. Croes, C. E., of New York City, is preparing plans for new water-works here.

JAMAICA, L. I.—On April 11 the taxpayers voted that the Board of Trustees should contract for a water-supply. One hundred fire-hydrants will be erected.

NORFOLK, VA.—A better water-supply is wanted here. The Lake Drummond Water Company has made a proposition to the City Council offering to furnish a supply.

WATER COMPANY.—The Visitacion Water Company is a new organization which has just petitioned the Board of Supervisors for the privilege of laying mains and furnishing water in San Francisco. Water will be obtained from artesian wells.

KOKOMO, IND., will have water-works. The proposition was carried at city election, April 8, by a large majority.

ISLIP, L. I., is considering methods of sewage disposal.

OTTAWA, ONT.—Makers of pumping-engines should watch events here. A proposition has been made in the Board of Aldermen to expend $100,000 on new pumps for the water-works.

LOWVILLE, N. Y.—On April 7 Moffett, Hodgkins & Clark, of Watertown, N. Y., made a proposition to the citizens to build and maintain water-works. Their plan provided for a reservoir, pumping plant, and about six miles of mains; the works estimated to cost $50,000 to $60,000. The town was asked to pay $2,000 annually for five years. No definite action was taken. W. R. Fitch will call another meeting to act on the matter.

ELMIRA, N. Y.—Contractors should look out for work here. A few days ago the Board of Aldermen passed a resolution directing the City Engineer to prepare plans for sewerage and to advertise for proposals.

SYRACUSE, N. Y.—A bill was introduced in the New York Legislature, April 6, authorizing the city to buy the works of the Syracuse Water Company for $675,000.

ONEIDA, N. Y.—The village has voted to raise funds for surveys for a general system of sewerage.

BROCKTON, MASS.—The present status of the drainage scheme is the report from the Drainage Committee of the Massachusetts Legislature of a bill authorizing Brockton to issue bonds for $200,000 for the work.

HAILEY, IDAHO.—Incorporated is the Gold Belt and Hailey Water Power Company. E. A. White, Alexander Willman, and J. M. Burkett.

WAYNESBURG, PA.—Address J. M. Singerly about proposed water-works here.

MEYERSDALE, PA.—Water-works will be built here by A. Chamberlain & Co.

DANVILLE, VA.—Address G. A. Ballou about water-works here.

GAS, STEAM, BUILDINGS, ETC.

PLANS WANTED.—Plans and specifications for the buildings of the University of Arizona will be received by the Regents at Tucson, until May 2. The successful architect will receive $500. Charles M. Straus is Secretary of the Board of Regents.

ONEIDA, N. Y., has voted to have electric-lights.

FAYETTE CITY, PA.—A natural-gas company has just been organized here, to sink wells along little Red Stone Creek.

AKRON, O.—A syndicate of Cleveland capitalists have leased 970 acres of land seven miles east of this city, where a number of gas-wells will be bored. Buildings will also be erected.

LIMA, O.—Gray Bros. & Co., oil producers, have secured right of way, and will lay natural-gas-pipe to Wapokoneta, a distance of thirty miles.

COLUMBUS, O., Natural-Gas Company is a new incorporation.

INCORPORATED in Ohio are the Miamisburg Gas and Petroleum Company; the Felicity Gas and Oil Company, of Manchester; the Elyria Gas Company.

INCORPORATED is the Babylon, L. I., electric-light compay. Leopold H. Fishel, Richard Higbie, Jr., and others, of Babylon, stockholders.

UTICA, N. Y.—The Utica Electric and Gas Company, consolidated out of the Utica Gas-Light Company and the Central New York Electric-Light and Power Company, has just been incorporated. The capital is $300,000.

DOVER, N. H., Aldermen on April 7 granted a license to Henry W. Burgess, of Boston, to operate an electric-light plant in the city. It will be the Thomson-Houston system, and the plant will cost $400,000.

PEORIA, ILL.—Incorporated is the Union Gas, Oil, and Mineral Company. E. G. Minnemeyer, William McGinnis, Charles Wallenwater, incorporators.

ANNISTON, ALA.—A gas company, capital $50,000, has been chartered to build works here.

BALTIMORE, MD.—On May 31 the contract of the city for 485 electric-lamps will expire, and the authorities are considering the making of new contracts.

BETHLEHEM, PA., has made a contract with the Electric-Light Company to light the streets for three years.

WOBURN, MASS.—The town has instructed the Selectmen to make a contract for lighting the town with electric-lights.

RAILROADS, BRIDGES, CANALS.

INCORPORATED is the Bridgeport and Chicago Railroad Company, to build a road to connect with the Chicago and Great Western Railroad and extend to the Indiana State line. Frank L. Hankey, Edward L. Burghhardt, and others are incorporators. The principal office is in Chicago.

RAILROAD.—The La Grange, Tenn., Furnace Company will build a railroad from Danville to La Grange Furnace. The headquarters of the company is Nashville, Tenn.

INCORPORATED is the Chicago Terminal and Connecting Railroad Company, of Chicago, to build from Chicago to Blue Island. George D. White and John D. Adair, of Hyde Park, Charles T. Gregory, of Chicago, and others are incorporators.

THE Griffin, La Grange, and Western Railroad, the Macon and Covington, and the Savannah, Dublin, and Macon have united under the name Birmingham and Atlantic Air Line, and will build to the coast. Birmingham, Ala., is the headquarters.

INCORPORATED is the Chattanooga Land, Coal, Iron, and Railway Company. J. W. Adams, President.

NOTASULGA, ALA.—The Notasulga Granite Company is having surveys made for a railroad from the town to the quarries.

NASHVILLE, TENN.—It is settled that a union depot will soon be built here.

BANGOR, ME.—A railroad, 34 miles long, to cost about $400,000 will be built soon to Milo. Surveys will be made at once.

HELENA, ARK.—The Helena Street Railroad Company will build a road here. Greenfield Quarles is President; D. T. Hargraves, Secretary.

MILWAUKEE, WIS.—Bids will be opened April 19 for dredging the Milwaukee River during the season of 1887.

ALBANY, N. Y.—The Board of Contract has rejected the bids for cleaning the streets, and ordered new bids advertised for. The City Engineer has prepared specifications for about 18,000 square yards of granite street-paving.

BROOKLYN.—George H. Radford, C. E., has prepared plans for a canal from Jamaica Bay to the centre of the Twenty-sixth Ward, and a stock company is being organized to carry the scheme through. The total cost is about $500,000. Rudolph Reimer, of Brooklyn, is one of the projectors.

BRIDGE.—See our Proposal Column for notice in reference to the bridge over Arthur Kill between Staten Island and New Jersey.

BRIDGE.—The Durham Iron Company has closed a contract with the Reiglesville, N. J., Delaware Bridge Company to build an iron bridge over the Delaware River at Reiglesville.

TACOMA, W. T.—The Skagit Railway and Lumber Company has filed articles of incorporation. Byron Barlow, Calvin S. Barlow, W. J. Thompson, Paul A. Paulson, J. D. Caughran, and Harry Drum are incorporators. The company proposes to build a railroad, docks, warehouses, and steamboats. Tacoma will be the headquarters.

PARKERSBURG, W. VA.—Bridge builders should watch events here. It has been decided to build a railroad bridge over the Great Kanawha. Colonel Merrill, U. S. Engineers, of Cincinnati, is being consulted about it.

EAU CLAIRE, WIS.—The Council has awarded the contract for the construction of the Water Street bridge to H. E. Horton, of Faribault, Minn., for $10,500, the structure to be completed August 1. It will be 860 feet long, and the contract includes the completion of the approaches.

ST. PAUL.—Incorporated: St. Cloud City Street Car Company. The company proposes to construct, maintain, and operate railways in the streets of St. Cloud, and its additions in the County of Stearns, in East St. Cloud, and its additions in the County of Sherburne, in Sauk Rapids, and its additions in Benton County. Principal place of business, St. Cloud. Incorporators, C. P. McClure, A. G. Whitney, L. T. Troutman, R. L. Gale, H. E. Tolman, O. W. Baldwin, Frank Tolman, all of St. Cloud.

BIDS OPENED.

CLEVELAND, O.—Carpenter & Jewett, contractors, have secured the contract at $6,000 for building a bridge over Morgan Run.

PITTSBURG, PA.—The Board of Health has awarded the contract for building a thirty-ton garbage furnace to the Rider Garbage Furnace Company at $3,000.

JERSEY CITY, N. J.—Bids were opened by the Board of Freeholders April 7 for the hospital pavilion, and the annex to the penitentiary, as below: P. J. Condon, annex complete, $38,000, from which he will deduct $1,000 if the gates and cell doors are made of iron; hospital pavilion completed, $20,000; Wallis Iron-Works, annex complete, $41,983; Francis C. Meehan, mason-work to annex, $20,949; J. H. Cutley, annex, $34,987, with $1,114 additional for Krome steel cell doors; mason-work on pavilion, $11,974; Neil Campbell, pavilion complete, $23,712; annex, $33,874 complete, except carpenter work, for which he wants $4,000; if ordinary wrought-iron will answer for the cell doors, he will deduct $690 from estimate; J. T. Rowland, mason-work for annex, $24,215; Mansfield & Fagin, iron-work on annex, $12,114; without wrought-iron, instead af Krome steel doors, $11,424. The bids were referred to the Building Committee.

DOVER, N. J.—The following bids for constructing a 5,000,000-gallon reservoir were received by Isaac S. Cassin, Engineer of the Dover Water Company, April 9: F. A. Snow & Co., Providence, R. I., $55,000; Thomas Hayden, New York City, $18,000; William H. Evans, Philadelphia, $14,500; George Strowhour & Co., Philadelphia, $14,210; Reilley & Paddock, Newton, Pa., $13,754.63; Sommers & Russell, Philadelphia, $13,468; Rooney & Finnegan, Paterson, N. J., $13,200; Seymour L. Bartholomew, Asbury Park, N. J., $13,186.

BROOKLYN.—Bids for cleaning the streets and removing ashes for the next three years were opened (for the second time) by the Commissioner of City Works April 11, as follows:

Cranford & Valentine—For removing ashes, first year, $130,000; second year, $140,000; third year, $150,000. Cleaning streets, $25 per mile.

William D. Veeder—For removing ashes, first year $130,000; second year, $130,000; third year, $140,000. Cleaning streets, first year, $26 per mile; second year, $27 per mile; third year, $28 per mile.

John H. O'Rourke—For removing ashes, first year, $135,000; second year, $140,000; third year, $143,000. Cleaning streets, $28 per mile.

Thomas Monohan—For removing ashes, first year, $132,000; second year; $149,000; third year, $159,000. Cleaning streets, first year, $29 per mile; second year, $30 per mile; third year, $31 per mile.

Peter Blake—For removing ashes, first year, $135,000; second year, $150,000; third year, $175,000. Cleaning streets, first year, $30 per mile; second year, $31 per mile; third year, $33 per mile.

Only $160,000 has been appropriated, while Cranford & Valentine's bid will amount to $300,000. It is expected the State Legislature will grant authority to raise the extra sum.

ALTOONA, PA.—Bids for water-pipe, special castings, and stop-valves, among other supplies, were opened by the Board of Water Commissioners April 14. Quantities were: 7,416 feet of 4-inch pipe; 1,860 feet of 8-inch pipe; 14 4-inch valves; 2 6-inch valves; 3 8-inch valves. Bidders and prices were as follows:

BIDDERS.	Water-pipe.	4", 6" and 8" Stop-Valves.	Special Castings.
National Foundry and Pipe Works, Limited Scottdale, Pa.	4" 20c. per ft.		
" " "	8" 47c. per ft.		
" " "	$36.60 per 2,000 lbs.		$0.03½
Jackson & Woodin Manufacturing Co., Berwick, Pa	4" $36.25; 8" $34.25		2.85
Mellert Foundry and Machine Co., Reading, Pa	$36.20		0.02¾
" " "	$33.60	$10.00; 15.00; 24.00	
Bailey, Farrell & Co., Pittsburg, Pa		9.40; 15.25; 22.75	
Eddy Valve Co., Waterford, N. Y		9.00; 15.50; 22.25	
Walter S. Rayner & Co., Fostoria, O		8.00; 13.75; 20.00	
Lehigh Valley Brass Works, Bethlehem, Pa		8.75; 14.50; 21.50	

GOVERNMENT WORK.

DULUTH, MINN., U. S. Engineer Office.—The following bids for dredging in the Harbor of Duluth, repairs to piers of canal, and placing buoys, were received by Captain J. B. Quinn, U. S. Engineer, April 7:

BIDDERS.	Dredging in the Harbor of Duluth, Minn. Price per cubic yard.	Repairs to the Piers of Canal.	Placing Buoys in the Harbor.
Carkin, Stickney & Cram, East Saginaw, Mich	26½c.	....	...
Truman & Cooper, Manitowoc, Wis	17½c.	....	....
Peter Lambert, Duluth, Minn	......	$10,705.75	....
Norris G. Dodge, Chicago, Ill	19c.	....	....
Renseler R. Dodge, Fulton, N. Y	22c.	....	....
Green Bay Dredge and Pile-Driver Co., Green Bay, Wis	18c.	....	....
Charles D. Barker, Duluth, Minn	15 8/10c.	7,800.00	$375.00
Williams, Upham & Co., Duluth, Minn	15½c.	....	....

JACKSONVILLE, FLA.—The following bids for dredging in harbors, as below, were received by Captain William M. Black, U. S. Engineers, April 11:

Improving harbor at Cedar Keys, Fla.—S. N. Kimball, Apalachicola, Fla., dredging, 47½c. per cubic yard.

Improving harbor at Tampa, Fla.—S. N. Kimball, Apalachicola, Fla., dredging 44c.; rock excavation, $6.90; John Maguire, Mobile, Ala., rock excavation, $5.90.

Improving Manatee River, Fla.—S. N. Kimball, Apalachicola, Fla., dredging, 50c.

AUGUSTA, ME.—Synopsis of bids for iron beams, etc., for basement-floor of custom-house, etc., opened by the Treasury Department, April 9: Builders' Iron Foundry, Providence, R. I., $1,290; J. B. & J. M. Cornell, New York City, $1,200.

PORT TOWNSEND, WASH. T.—Synopsis of bids for brick and stone-work for basement and area walls of custom-house and post-office, opened by the Treasury Department, April 7:

BIDDERS.	Amount.	Additional for steps of granite.
Bartlett & Wilkes	$7,580 00	......
Stephen Carkeek	12,637.50	$1,400
Joseph Sonmey	9,443.00	500
M. J. Carkeek & Co	7,500.00	300

JEFFERSON CITY, MO.—Synopsis of bids for joiner-work and wood flooring of basement and first floor, window-frames, and sashes for the entire building, including the necessary glass, hardware, and painting for court house, opened by the Treasury Department April 11:

BIDDERS.	Amount of Bid.	Additional flooring Rate per sq. ft
Cudell & Lehman, Chicago, Ill	$8,664.50	$12.50
John Moore, Syracuse, N. Y	11,760.00	15.00
McCarthy & Corbett, Washington, D. C	8,500.00	10.00
Joseph W. Given, St. Louis, Mo	10,717.00	10.50
Robert Mitchell Furniture Co., Cincinnati, O	11,920.00	12.00

LYNCHBURG, VA.—Synopsis of bids for iron stairs for post-office, opened by the Treasury Department April 13: Poulson & Eger, Brooklyn, N. Y., $4,900; Manly & Cooper Mfg. Co., Philadelphia, Pa., $5,375; J. L. Bolles & Co., Detroit, Mich., $5,472; Snead & Co. Iron-Works, Louisville, Ky., $5,245.

DAVIDS ISLAND, N. Y. H.—The following bids for two sets of officers' quarters were received by Captain George H. Cook, Deputy Quartermaster, U. S. A., March 16: Richard P. Fallon, New Rochelle, $5,200 for the entire work; Francis H. Smith, New York, $5,900; Richard Calrow, Brooklyn, $7,250; Edward Murphy, New York, $8,973. The contract was awarded to Richard P. Fallon.

PHILADELPHIA, PA.—Abstract of proposals for constructing a dike in Delaware River, from the lower end of Reedy Island, received in response to advertisement dated March 7, and opened April 8 by Lieut.-Col. Henry M. Robert, Corps of Engineers:

BIDDERS.	Approximate Quantities. Brush mattress, 4,000 cubic yards. Per cubic yard.	Approximate Quantities. Stone, 14,000 cubic yards. Per cubic yard.	Amount
Francis H. Smith, New York	$2.00	$2.00	$36,000
John A. Bouker, New York	1.67	1.63	29,500
Ira Lunt, New Castle, Del	1.74	1.50	27 960
Milo W. Locke, Kentmere, Del.	1.40	1.45	*25.900
John Satterlee, Englewood, N.J.	1.53	1.49	26,980
Alex. J. Howell and Sherman Petrie, New York	.73	1.62½	†25,670

* Recommended for acceptance.
† Received after hour of opening; informal guarantee signed by bidders; no justification or certificate.

DULUTH.—Captain Quinn, U. S. Engineer, in charge of Duluth harbor, has awarded the contract for dredging in Duluth harbor this summer to Williams, Upham & Co., of this city at 15½ cents per cubic yard, and the contract for repairing piers to Charles S. Barker, of this city, for $800, and for placing buoys for $375.

MISCELLANEOUS.

ST. PAUL, MINN.—The Western Pneumatic Dispatch Company, of this city, last week had a trial of the system of pneumatic delivery of parcels through tubes. An experimental tube 960 feet long was used through which a sphere containing packages was pneumatically delevered. A company has been formed with Mr. C. M. Johnson, of Chicago, the inventor, as President, F. R. Smedley, Vice-President, and L. N. Denslow, Secretary and Treasurer. It is proposed to build a line from St. Paul to Minneapolis when the necessary franchises are obtained.

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house· *ten*, tenement; *e*, each *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

AMONG THE ARCHITECTS.

We report the following from the offices of New York architects:

East Newark, N J.—Mill building for the Mile End Spool Cotton Company; main mill 226x126; engine house 50x60. The building will be five stories high with two towers at each end. There will also be a country house 42x25, two stories high, and an engine-house 21x32, two stories high. The building will have a freight elevator and there will be ten steam boilers in the boiler house. Mr. E. Umbach is the architect.

New York City—Stone church, to be known as the Church of the Blessed Sacrament. Located on Seventy-first Street, near Boulevard. Dimensions, 80x100. Seating capacity, 1,200. F. N. Le Brun & Son are the architects.

New York City—Brick building on Broome Street for Mr. Louis W. Jones. Six stories, flats and stores, 25x83. Messrs. Schneider & Herter are the architects.

New York City—Brick building on Ludlow Street for Mr. Louis W. Jones. Six stories high, 25x75. Schneider & Herter, architects.

Montclair, N. J.—Architect C. D. Marvin is preparing plans for a three-story frame cottage for Mr. Joseph Van Vleck; dimensions, 40x45; cost, $9,000.

Yonkers, N. Y.—Extensive alterations will be made to the four-story stone and brick building occupied by the B'nai B'rith Society as a Home for the Aged and Infirm; a large sum of money will be expended; Messrs. Marshall & Walter are the architects.

Somerville, N. J.—Two three-story stone and brick wings will be added to the public school building; C. P. H. Gilbert is the architect.

NEW YORK CITY.

737 Broadway, 1 7-story and basement br and stone store bldg; cost, $135,000; agents, F. R. & H. E. Jones, 21 East 11th; a, E. D. Lindsey; m, C. T. Wells; c, W. Germond; iron, Post & McCord.

47–49 Catherine, 2 5-story and cellar br tens; cost, each, $22,000; o, M S Korn, 138 E 47th; a, A I Finkle; b, not chosen.

79–87 Stanton, 5 5-story and basement br tens; cost, corner $18,000, others $14,000 each; o, L Z Bach, 210 E 50th; a, Oswald Wirz.

120 Broome, 5-story basement and cellar br and br st ten; cost, $20,000, o and m, Chas Downey, 155 E 106th; a, A I Finkle.

Delancey, n s, 50 e Norfolk, 1 5-story and basement br ten; cost, $18,000; o, A J Grozcky, 112 E 109th; a, J C Burne; b, day's work.

7 Elizabeth, 1 5-story and basement br ten; cost, $22,000; o, Abraham Levinson, 105 Bayard; a, F Ebeling.

141, 143 and 145 Norfolk, 3 6-story br tens; cost, each, $20,000; o and a, Jobst Hoffmann, 101 E 7th; m, Gustav Staiger.

217 W 31st, 5-story br flat; cost, $24,000; o and a, Adolph Koschel, 228 W 52d.

45th, s s, 240 e 1st av, 3-story br stable; cost, $30,000; Schwarzchild & Sulzberger Refining Co. (Ltd), 45th and 1st av; a, A B Ogden & Son.

59th, s s, 200 w 5th av, 4-story cellar and basement b s and br dwell; cost, $80,000; o, Charles A Stein, 227 E 52d; a, T S Goodwin; b, not given out.

19th, s s, 199 w 8th av, 5-story b s flat; cost, $20,000; o and b, James B Gillie; a, M V B Ferdon.

916 2d av, 5-story and cellar br ten; cost, $18,000; o, M S Korn, 138 E 47th; a, A I Finkle; c, not chosen.

60th, s s, 303 w 1st av, 2 5-story br tens; cost, each, $18,000; o, Wm A Juch, 401 East 106th; a, George Matthias.

241 E 81st, 5-story b s ten; cost, $12,000; o, Mary Healy, on premises; a, T J Sheridan.

106th, s s, 225 w 1st av, 4-story br ten; cost, $12,000; o, Charles McCloskey, 70 E 85th; a, J F Burrows.

122d, n s, 100 e Madison av, 5-story br ten; cost, $20,000; o, Henry Riehl, 240 W 29th; a, Henry Davidson.

14–16 W 125th, 5-story br flat; cost, $35,-000; o, Jacques Bach, 240 E 27th; a, Jobst Hoffman.

N s 120th and s s 121st, 86 from Sixth av, 10 br dwells; cost, $250,000 all; o and a, as above.

345–347 Grand, br store and factory; cost, $20,000; o, Joseph L O'Brien; a, Frederick Jenth.

22 West 18th, br dwell; cost, $15,000; o, Florence E Allien; a, R W Buckley.

N e cor Riverside Drive and 108th, br dwell; cost, $65,000; o, Emily Bayne; a, Joseph M Dunn.

161 West 15th, br ten; cost, $22,000; o, Julius Langenbahm; a, J Hoffmann.

430 E 9th, br ten; cost, $18,000; o, Jacob Wiehe; a, E W Greis.

N s Delancey, 50 e Norfolk, br store and dwell; cost, $18,000; o, Abraham J Grozcky; a, John C Burne.

N s First av, 100 n 118th, 2 br stores and ten; cost, $36,000 all; o, Newman Cowen; a, George Matthias.

191–193 Madison, 2 br tens; cost, $36,000 all; o, Morris Grosner; a, Charles Rentz.

60–66 Cannon, 4 br tens; cost, $68,000 all; o, Isaac Renaldo; a, as above.

26 Bowery, br warehouse; cost, $16,000; o, Charles Gaitens; a, as above.

N s 78th, 175 w First av, 2 br dwells and stores; cost, $28,000 all; o, Moore & McLaughlin; a, A B Ogden & Son.

W s 10th av, 50 n 140th, 2 br tens; cost, $35,000 all; o, Miles A Stafford; a, Henry Davidson.

38–40 Morton, 2 br flats; cost, $52,000 all; o, Henry M Postevin; a, George Orr and J J Roberts.

49–53 Leroy, 3 br flats; cost, $60,000 all; o and a, as above.

26 Laight and 5 Vestry, br storehouse; cost, $35,000; o, Mrs A D Juillard; a, Richard Berger.

N s 146th, 100 e 8th av, 5 br tens; cost, $75,000 all; o, Florena B Irvine; a, J H Valentine.

19–21 Roosevelt, br storage; cost, $35,000; o, Catharine Garrick; a, Joseph M Dunn.

N e cor 104th and Madison av, 6 br dwells; cost, $33,000 all; o, F H Allen; a, W S Jennings.

2 Birmington, br shop; cost, $15,000; o, Lewis Krulewich; a, Adam Munch.

59 Broome, br dwell; cost, $20,000; o, Emmett H Smith; a, Berger & Baylies.

N s 11th av, 50 n 68th st, 3 br stores and tens; total cost, $54,000; o, Newman Cowen; a, Geo Matthias.

336 Greenwich st, br storage bldg; cost, $18,000; o, C J Couller; a, Berg & Clark.

E s 4th av, 50 and 100 n 118th st, 2 br tens and stores; total cost, $24,000; o, Christian Brand; a, Andrew Spence.

N s 93d st, 150 w 9th av, 6 br dwells; total cost, $90,000; o, Jacob Hays; a, F. P. Wright.

S s 69th st, 210 e 3d av, 6 br dwells; total cost, $54,000; o, W C Schermerhorn; a, H J Hardenberg.

S e cor 10th av and 56th st, br store and dwell; cost, $20,000; o, Pat Skelly; a, J. B. Snook & Sons.

N e cor 89th st and 9th av, 4 br dwells; total cost, $64,000; o, Gordon Bros.; a, G. A. Schellenger.

N s 58th st, 145 e Broadway, br stable and dwell; cost, $14,000; o, Dan A Lorning; a, Con O'Reilley.

S w cor 116th st and Pleasant av, br dwell; cost, $16,000; o and a, Henry Neus.

E s Pleasant av, 25 s 116th st, 3 br tens; total cost, $42,000; o and a, same as above.

E s Pleasant av, 100 s 116th st, br dwell; cost, $16,000; o and a, same as above.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 21. PUBLISHED EVERY SATURDAY.

NEW YORK, APRIL 23, 1887.

LONDON, MAY 7, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

ARCHITECTURAL EDUCATION.

THE question is so often asked, What is the necessary training for an architect? and the discussion on the proper course for a college graduate to take who contemplates adopting architecture as his profession, which has been going on in recent issues of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, suggests that it may be worth while to consider a little of the routine through which the most successful members of the profession have been obliged to pass. It must be remembered that the conditions have changed more in this country in reference to architectural training than as regards any other profession, and what might have been considered amply sufficient for the architects of the past generation does not in any degree answer for one who intends to practice to-day. Very few of the many young men who every year enthusiastically proclaim their architectural intentions have any clear idea of the amount of hard, unremitting, all-absorbing work which must be done before they can be called architects in the true meaning of the term. No amount of talent, or even decided genius, can make the work any less exacting. The most brilliant of architects are invariably the hardest-worked members of the profession. So it behooves the beginner to consider well, not only his inclinations toward this particular department of art, but also his willingness to work hard and his physical ability to stand the strain.

An architect must first of all have a good general education. He will have to deal with gentlemen, and unless he can meet them on an equal footing his chances of self-respect are but small. An exhaustive technical, or rather engineering, education is apt to be a hindrance rather than a help. Aside from a certain limited amount of calculation, the engineering ability involved in the construction of even the heaviest buildings is a matter of experience and judgment rather than of abstract learning. So the next step in the evolution of the architect is to follow the course at one of the architectural schools, which course should be determined by his previous education—*i. e.*, whether he enters at eighteen or as a college graduate of twenty-one, whichever it may be, it will give him all the mathematics he wants, and more than he will ever use, besides laying a foundation for the after-growth of art, which constitutes the soul of architecture. This may occupy two, three, or four years. Then the student becomes a draughtsman for a year or two, gaining experience in the routine of office-work and an appreciation of his own needs and artistic shortcomings. Then follows not less than two years in one of the *ateliers* of the Ecole des Beaux Arts, and, finally, the usual round of travel and observation throughout Europe—in all about nine years of schooling, office-work, and travel. This may seem a great deal of time to spend in mere preparation, but we have only to look at the careers of the leading architects of to-day to know that this has been the rule rather than the exception. Neither can there be any question but that, though our architectural schools are very thorough in all their departments and are every year becoming more efficient in their training, they are not sufficient to give an architect the complete education he is obliged to have if he would keep up with the progress of American art. Paris would be a very poor place in which to begin one's architectural studies. The rudiments, the foundation, and the practical exigencies are best understood here, and, as far as concerns convenience, comfort, stability, or the management of business, we have little to learn from Europe; but nowhere in the world is the art of architecture so well appreciated and imparted to the earnest student as in Paris. Nine or ten years is none too long a time to give to preparation for a life's work; and the men who are regarded the leading men of the profession to-day have all followed essentially the same routine, spending more time rather than less in the Paris school.

RAINFALL AND WATER-SUPPLY.

THE "Journal of the Franklin Institute" for April contains a paper on the above subjects, read by John Birkenbine before the Institute in February last.

The first part of the paper is devoted to showing in terms adapted to popular comprehension the enormous volume and weight of rainfall and the power required to raise the water of which it is composed. Every twelve inches of rainfall on a square mile gives a volume of 27,878,400 cubic feet, or 208,530,432 gallons of water, weighing 64,533 gross tons. The area of the city of Philadelphia is 129.4 square miles, and four inches of rain on this area weighs as much as all the anthracite coal mined in the State of Pennsylvania during a year. The average annual rainfall at Philadelphia for the last fifty-seven years has been 45.19 inches, and, to raise the amount of water which this would produce on the area of Philadelphia to an average cloud-level of 10,000 feet, if done by pumping-engines working at the rate of one million foot pounds per pound of coal burned, would require 3,773,146 tons of coal.

As regards the water-supply of Philadelphia, while defects and deficiencies are admitted, Mr. Birkenbine thinks that Philadelphians are too apt to display and make public their disadvantages, saying that "an absence of local pride seems to be pre-eminent among our citizens, and we seldom or never put our best foot forward."

Possibly the daily press of Philadelphia may be stimulated by this remark to be less modest in their claims, but it may be difficult for some of them to come up to Mr. Birkenbine's standard. He thinks that Philadelphia will obtain the best water-supply by gravitation from the tributaries of the Schuylkill and Delaware Rivers, that it should not be dependent on one source only, and that to have a proper control of the areas drained they should be the property of the city. Much of the area which should be purchased is imperfectly adapted for agriculture, but if properly cared for could sustain valuable forests. A great city maintaining a magnificent forest preserve, wherein tree-culture could be carried on, having the double purpose of maintaining the purity of the water-supply and the growth of timber for profit, would do much to popularize a much-neglected feature of State and National administration.

RESPONSIBILITY FOR ALTERED SPECIFICATIONS.

A CASE was recently decided in favor of a contractor in Hartford, in which the question of liability for alteration of the specification was involved after bids had been made.

It seems that Messrs. Angus & Dallas, of Hartford, had made a bid in writing for work, in accordance with specification submitted on a house for a Mr. Olmsted, of that city.

The contract was afterward brought to them to be signed, but instead of the specifications presented to them in the first instance, the contract included a revised set of specifications which the contractors held increased the expense of the proposed work $1,000. They refused to sign the altered specifications, and the contract as modified was taken by another builder. Mr. Olmsted sued to recover the $1,000 difference between the two bids, but the jury found the facts to be as stated by defendants.

Under these circumstances it is difficult to understand how any different result could have been expected, or why such a suit should have been instituted.

---

ary furnace at the foot of the shaft. As the gases, smoke, etc., are in some instances taken a second time through the furnace before being discharged into the flue, the probable effect of the proposed remedy might easily be ascertained.

Considerable attention has lately been directed in railway circles to the question of color-blindness among railway employees. This, of course, effects the safety equally of railway property and public life, and is consequently of general interest. The secretary of an amalgamated society of engine-drivers and railway servants points out, however, that the result of tests in several cases may not be, and indeed is not, well founded. He states that in his own knowledge many men are disqualified as color-blind who are not so. They recognize, and could identify, various colors correctly, but, owing to a deficiency of education in that direction, are unable to describe the various shades by their proper terms. The question is one meriting attention at the hands of the railway authorities, and it is not of course sought that any man should have the intimate acquaintance of an oil and water-color painter, with the water-supply, no ventilation of the plumbing system, and imperfect isolation of the buildings from the seweis and cesspools are some of the shortcomings pointed out by the superintendent. The governors of the asylum, alarmed at the report, have appointed Mr. W. K. Parry, an engineer of Kingston, to report upon the condition of the institution, with a view to abolishing the evils. This asylum is probably the largest in Ireland, accommodating eleven hundred patients.

SAFETY VALVE.

OUR SPECIAL ILLUSTRATION.

A WAREHOUSE BUILDING.

THE subject of our special illustration is a building intended and used for furniture warerooms and owned by George A. Schastey, Jr. The front is Caulabaugh and Philadelphia pressed brick. The interior has a large hall, with red numismatic marble mantels, antique oak wainscot, columns with bronze caps and bases, staircase thirteen feet wide. The architect was John H. Duncan of New York.

RESIDENCE OF MR. J. M. WHITON, PLAINFIELD, N. J.—ROSSITER & WRIGHT, ARCHITECTS.

OUR BRITISH CORRESPONDENCE.

Electric-Lighting in England—Refuse Destructors a Possible Nuisance—Color Blindness in Railway Employees—Eiffel's Tower at Paris Exhibition—Insanitary Condition of Richmond Lunatic Asylum, Dublin.

LONDON, April 6, 1887.

COMMENT upon the comparative stagnation in electric-light enterprise in England, consequent upon the existing state of the law treating installations for public service, is afforded by the reports continually received from the Continent of fresh installations. The engineers in the greater proportion of these cases are English firms.

The discussion incidental to the passing of a bill through the House, empowering the erection of a destructor, brought out considerable opposition to the proposal on the ground of possible nuisance from a very fine ash given off by the flue. It would appear that in some existing destructors the ash is principally due to paper consumed in the furnace, and the said ash being very light is carried up the flue by the strong draft, and does really create a slight nuisance. It is proposed to remedy the evil by a subsidi- various shades of color, in order to qualify him for a position as a railway employee.

To meet the necessities of his tower, now in course of erection in Paris for the 1889 Exhibition, notwithstanding the opposition, M. Eiffel has designed a new type of lift. The problem was to avoid the necessity of changing the visitors who desired to make the ascent from one series of lifts to another, and at the same time to provide a system of conveyance whereby absolute safety and security against the chance of a too rapid descent was secured. To effect this the principle of a screw and nut is adopted, a trolly traveling spirally under the passenger cage, with a series of wheels running on rails. The cage itself does not, however, revolve, being maintained in its direct ascent by guide-rods. The pitch of the screw will, of course, govern the rate of ascent or descent.

The report for 1887 of the Resident Medical Superintendent of Richmond Lunatic Asylum in Dublin shows a deplorably bad sanitary condition. What it is may be judged from the fact that in the female wards old bath-tubs have been used for trough water-closets. Insufficient

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE OF MR. J. M. WHITON, AT PLAINFIELD, N. J.—ROSSITER & WRIGHT, ARCHITECTS.

THE subject of our vignette illustration this week is the residence of Mr. J. M. Whiton, at Plainfield, N. J. The first story is of brick, 10-inch hollow walls, with "rustless iron" ties, shingles elsewhere, hardened finish; cost, $9,000. The architects were Messrs. Rossiter & Wright, of New York.

OUR SHEET OF DETAILS.

OUR detail sheet, the ninth in the series, shows an old colonial doorway in Baltimore, the residence of Cardinal Gibbons.

THE report of the Port Sanitary Authority of Liverpool for the year 1886 shows that the total number of vessels entering the port during the year was 20,928. Of these 4,120 were inspected, and 3,844 were found in fair or good sanitary condition, while 276 were defective; 191,491 emigrants embarked during the year.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

A NEW YORK COMMERCIAL BUILDING.

JOHN H. DUNCAN, ARCHITECT.


Scale of Detail
Date about 1806.
Residence of (painted white)
Cardinal Gibbons N. Charles St.
Baltimore Md.
Measured and drawn for The Sanitary Engineer and Construction Record
J.E. Wallis.

BUILDING CONSTRUCTION DETAILS.

No. IV.

(Continued from page 399.)

THE building practice of the United States presents so many different local usages that architects and builders in the East or South would find a great deal in the constructions used throughout the West and North which would be new to them, and from which some valuable suggestions could be obtained, while the converse is also undoubtedly true. Probably nowhere in the world is the architect obliged to consider climatic exigencies so carefully as in this country. We have to contend with the tropical heats of the South, where everything has to be constructed with a view to the free passage of air; the long droughts of the West, which will warp and twist the most thoroughly seasoned woods; the damp, sticky east winds of the North Atlantic States, which work the moisture into every exposed joint and through every ill-constructed wall; and the long, bitterly cold winters of the North-west region, where the ordinary constructions of the East would be quite inadequate to resist a temperature often remaining for days as low as $-40°$. It is with some of the devices adopted to meet the last of these difficulties, especially those in use in the twin cities of St. Paul and Minneapolis, that the present paper would deal; and it might be said incidentally that these constructions, primarily designed to resist a low temperature, would possibly prove equally efficacious in resisting the excessive heat of our long Eastern and Southern summers, on the same principle that the Arab wraps his sheepskin about his head to keep him cool.

Naturally, the greatest difficulty in protection against cold is encountered with buildings of wooden construction; and as comparatively few of the Minnesota residences are built with masonry walls, something more than a mere studded and sheathed wall is necessary. Figure 1 shows the construction in use for ordinary work. Inch strips are nailed to each side of the 2x4 studs to receive lathing and a heavy rough coat of back plastering. The wall is finished inside with lath and plaster in the usual way, and is boarded outside with ⅞-inch matched boarding. Over this are laid two thicknesses of heavy building-paper, and finally the finished clapboards. It has been found in practice that tarred building-paper is not suitable for the climate, as it acts upon the wood, causing it to rot, and in time it will become dry and will crack sufficiently to allow wind to pass through. Shingled walls are occasionally used in Minnesota, but the architects seem to prefer clapboards, as being both warmer and cheaper.

The construction shown by Fig. 1, if executed with care in all its details, affords two dead air-spaces between the studs, and is sufficiently warm for most houses, but a better and a warmer plan is to back plaster on the inner face of the studs and fur out with ⅞-inch strips for the finished plastering. The obvious advantage is that the back plastering is not then affected by any shrinkage of the studs, and is hence more apt to remain unbroken over the entire wall; while the only disadvantage is that the finished wall is two inches thicker than with the first construction. In some cases, matched sheathing is used instead of the back plastering, as shown by Fig. 2, and the St. Paul architects rather prefer this last method, though it is slightly more expensive.

It is sometimes found desirable to finish the exposed surfaces of gables with rough-cast plaster. The construction is then as shown by Fig. 3. Tongued and matched sheathing is let in between the studs, and kept back one inch from the face of the rough work. Heavy building-paper is bent around the studs and across the sheathing, being nailed only to the sides of the studs, and over this the laths are nailed, three-eighths of an inch apart. Half-seasoned laths are found to be most suitable, as the mortar adheres to them more closely than to perfectly dry stock. The details of mixing and applying the mortar may be of interest in this connection, though they are essentially the same as are customarily observed elsewhere. The mortar is occasionally made with equal quantities of lime and cement, but such a compound sets too quickly and is apt to crack. The best proportions are one and a half parts of strong lime to three parts of sand, with as much curled hair as the mortar will take up. The work is put on in one coat, made as thick as will stay on the lath, and pressed in thoroughly. As the mortar is applied, a man follows with coarse sand and screenings, which are thrown against the wet plaster to give it the rough, gray look so dear to the heart of the artist.

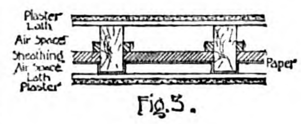


Fig.3.

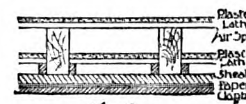


Fig.1.

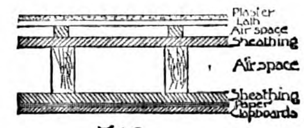


Fig.2.

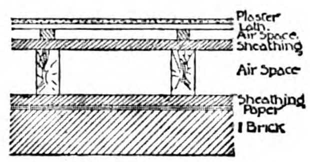


Fig.5.

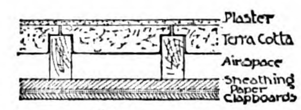


Fig.4.

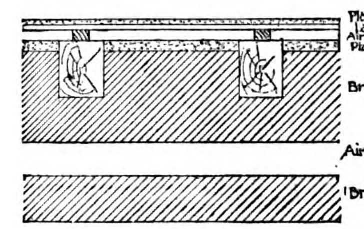


Fig 7

BUILDING CONSTRUCTION DETAILS

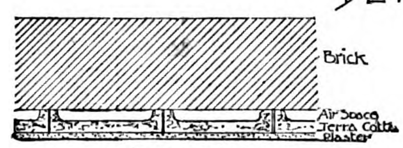


Fig.8.

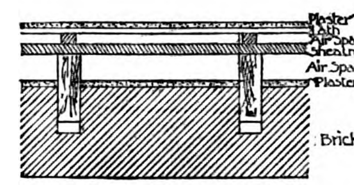
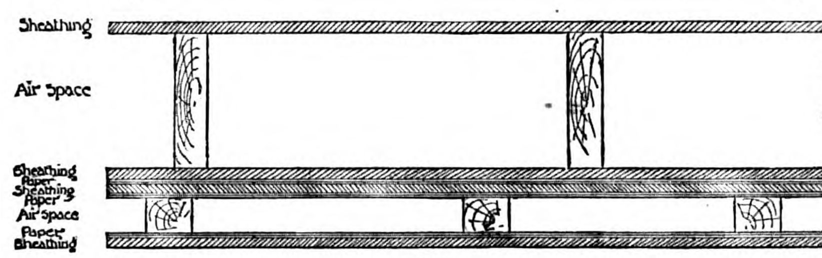


Fig.6.



"THE SANITARY ENGINEER AND CONSTRUCTION RECORD"

Fig.9.

Figure 4 shows a construction which will insure a warmer house than any of the other methods, when it is possible to use it throughout. The outside finish is the same as shown by Figs. 1 and 2. Porous terra-cotta blocks are set up between the studs, lapping over the face on each side by means of flanges, and presenting an unbroken lining toward the house. The finished plaster is applied directly to the terra-cotta. This system requires a little more care in framing and a few more timbers in the walls, but the terra-cotta is so light that the difference in an ordinary house need hardly be considered. The blocks are nailed directly to the studs. Occasionally the same idea is carried out in a different way by filling in between the studs with brick set edgewise, but the terra-cotta is so much lighter and neater in the construction that it is generally preferred. Still another variation is the brick-veneered house, which, by reason of its æsthetic deceit in appearing what it is not, should, of course, never be encouraged, though for some purposes it affords a construction which is very warm and quite easy of execution. Fig. 5 illustrates this. The wall is studded, sheathed, and plastered in any of the preceding methods, and is faced outside of the boarding with a 4-inch brick wall, generally starting from the stone foundation, if such exists, or even resting upon the wooden sill, which is made heavier and set out from the line of the studs for this purpose. The bricks are laid up in mortar and are secured from falling out by means of long spikes which are driven between the joints and into the boarding, one or two feet apart each way, depending upon the thoroughness of the work. This construction is one of the warmest in use, considering how cheaply it can be carried out, but it almost necessarily implies wooden window-caps and sills painted and sanded to imitate stone-work, wooden string-courses and all the artistic abominations incidental to a construction whose very merit lies in its falsity.

A recognition of the good qualities of the brick-veneered wall appears to have led to the evolution of a construction which has all of its merits and none of its æsthetic defects. This is illustrated by Fig. 6. Perhaps it would be fairer to call this a variation from the ordinary furred brick wall, though it partakes, to a certain extent, of the nature of the brick veneer. There is an outer wall of brick 8 inches thick; 2x6-inch studs are built into the wall, 16 inches on centres, with a 1-inch air-space behind each stud. The inner face of the brick-work is plastered one heavy coat between the studs. Then the studs are covered with ⅞-inch matched sheathing, furred with strips and finally lathed and plastered in the usual manner. This forms a very light, strong wall, and is quite warm. The brick is, of course, practically nothing more than a screen, and this construction is best suited to houses which are to show brick in the first story and wood above, the wood construction in that case virtually starting from the ground, with the added strength and warmth of the screen wall. This system was first used by Gilbert & Taylor, architects, of St. Paul.

The construction of the better class of masonry walls is shown by Fig. 7. A curious—possibly a wise—provision of the building law of St. Paul, requires that when brick walls are built with an air-space the inner portion of the wall shall be not less than 8 inches thick. When but 12 inches of brick-work is used, which is the usual condition, the outer portion is but 4 inches thick, and the air-space is left 3 inches. Wooden bricks 3x4x2½ inches are built into the inner face of the wall and set out one inch from the line of the masonry. The wall is then plastered one heavy coat between the wooden blocks, which serve to hold the furring strips for the finished plaster. Another construction sometimes followed is to build the brick wall solid and line it inside with porous terra-cotta blocks, shaped as shown by Fig. 8. These blocks are stuck to the walls with a little gauged mortar at the corners of each piece, or even nailed in place, and the finished plaster is applied directly to the face of the terra-cotta. This makes a stronger wall than Fig. 7, and one less permeable to moisture by reason of its greater thickness of unbroken masonry, while the air-space afforded by the terra-cotta blocks is sufficient for all practical purposes.

Only one other construction remains to be noticed, and this is devised to keep the cold in rather than to keep it out. The Stock-Yards Company of St. Paul has erected a large ice-house which is constructed substantially as shown by Fig. 9. The studs are 3x12 inches placed 32 inches apart and covered outside with matched and tongued boarding. On the inside of the studs there is first a thickness of 1-inch matched boarding, then two thicknesses of paraffine paper with lapped joints, then another thickness of 1-inch matched boarding and two thicknesses of paper. The wall is then furred with 3x4-inch studs laid flatwise two feet apart. To these are nailed two thicknesses of paraffine paper, and finally the wall is sheathed with matched and tongued boarding. No sawdust is used anywhere except at the door openings. It will be seen that this wall has two dead air-spaces, 12 and 3 inches wide respectively. It is by no means the cheapest method of ice-house construction, though it is believed to be the most perfect. The house is covered by an ordinary tar and gravel roof, with a 10-inch air-space formed by a sheathed ceiling hung from the roof-beams. The ice-house is divided into four chambers by studded partitions which are simply sheathed on each side.

(TO BE CONTINUED.)

THE TRAVELING BRIDGE BETWEEN ST. MALO AND ST. SERVAN, FRANCE.

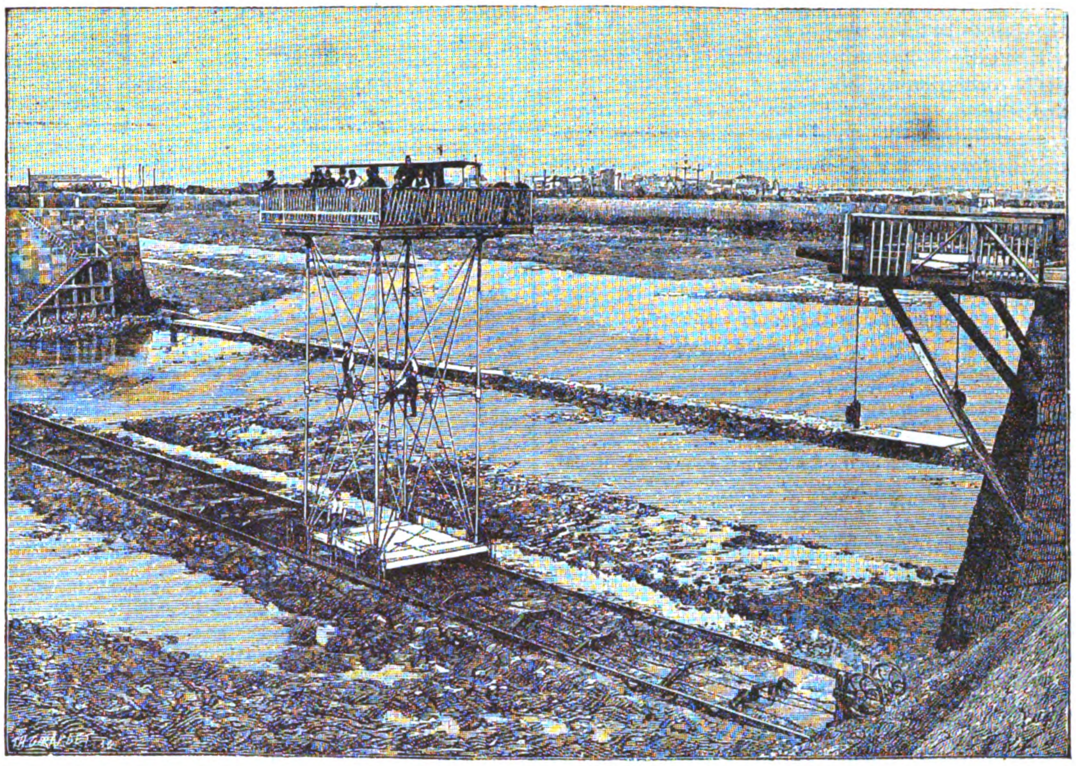
WE abstract a description of the traveling bridge from *Le Genie Civil* and *La Nature*, our illustrations being a reproduction of those appearing in the journal first named. The two cities of St. Malo and St. Servan, on the north coast of France, are separated only by a small arm of the sea. There is considerable traffic between the two cities, and communication by road is quite circuitous. Some sixteen years ago a Mr. Leroyer, a local architect, devised and built a traveling bridge or rolling ferry which has been in use ever since. Docks of masonry were built out from either side into the harbor, leaving a waterway of but ninety metres (300 feet); they are 10.50 metres (35 feet) high, the highest tides being ten metres (33 feet), and the bottom between these two docks is bare at low tide. On this bottom two tracks were laid on a prepared bed, on which a four-wheeled iron truck is run from one shore to the other by means of two cables laid on rollers on the bottom. On the truck is built up a light iron framework, composed of four posts and cross-ties, supporting a platform at the level of the docks. This platform is large enough for over 100 passengers; it can also carry teams, cattle, etc., and has a shelter in case of rain or hot sun. This frame travels backwards and forward at any stage of the tide, making the 300 feet passage in less than ninety seconds; the current due to the tide is frequently from five to six nautical knots. The motive power is taken from an engine situated on the dock at St. Servan. This engine drives a counter-shaft having two pulleys, with one straight and one cross-belt. These belts drive by gears a large drum situated below high water, so that frequently it is entirely under water. One chain from the bridge passes over a large wheel on the St. Malo side, then returns to St. Servan; the other passes directly to the St. Servan side, and both are brought over large wheels to the drums on which they are wound in opposite directions. On the St. Malo side the bridge fits into a recess in the masonry dock, and is thus protected from passing vessels.

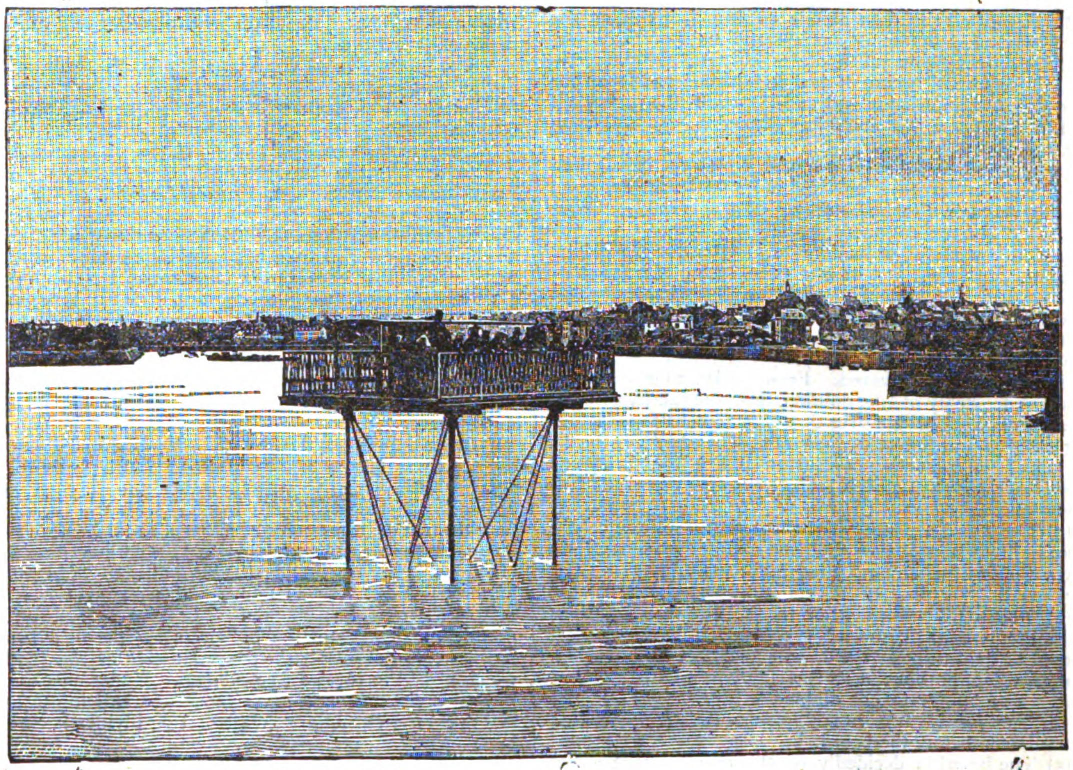
The advantages of this arrangement are numerous. The tide does not affect its working.

It is easily stopped for passing vessels, having no headway of its own, and will always answer its *helm*, and travel in a direct and sure line. Takes up little space when in the channel, and entirely out of the way when at rest.

It is not affected by wind or storm.

Of course, in case of ice, some contrivance would have to be devised to protect it from collision with large bodies.





TRAVELING BRIDGE.

CHELSEA, MASS., ENGINEER'S REPORT.

FROM the annual report of the City Engineer, Mr. William E. McClintock, for the past year we gather some interesting items. The street pavement that seems to have been decided upon is macadam, but the stone in the neighborhood is a rotten schisty slate, and unfit for the surface. A crusher has therefore been fitted up, with a specially designed elevator, by which the crushed stone is raised about 15 feet for screening, thus saving considerable manual labor and cheapening the process. The present cost is about $1.50 a cubic yard and 50 cents for hauling. To obtain a suitable rock from Malden, consisting of trap, porphyry, etc., will cost about $1.25 additional, or $3.25 per yard, aside for payment for the quarry. He recommends the soft material for foundation and the imported material for metaling.

Gravel has been used, but he says of it: "We have to let it be worn down by team travel, which may be an economy to the city, but is a great loss in wear and tear to the traveling public, both mentally and morally. This gravel is unsurpassed for paving purposes, but for street purposes *it is as well to use beans.*" In respect to repairs of streets, he says the cost is variously estimated in other cities at from 3 cents to 25 cents per square yard per year, and it is bound to cost as much in Chelsea as elsewhere, the lower limit being the least at which he would place it for the very least repairs that should be made, or a cost for the city of $35,000 annually, and $7,000 was the amount actually spent. Sweepings to the amount of 1,168 loads were removed from the streets during the year.

In reference to sewers, he says for some years they have adopted the rule of allowing no vitrified pipe to be broken into for connections; they now require a length to be taken out and a Y-branch inserted. The automatic flush-tanks in use have caused trouble from failing at times to work, and they now send a man around twice a month to run each for an hour, and then shut them off entirely. This keeps the sewers clean, and has caused him to decide not to use the automatic method in future.

His experience with manholes is that there is a constant flow of air in one direction or other through the perforated covers, in at one and out at another, with a velocity of 1 to 5 feet per second, and this causes the air in the sewers to be changed many times a day, so that the smell from them is scarcely perceptible.

The cost of cleaning catch-basins has been $2.94 each for the year. The old ones, with a brick cross-wall for the seal, have caused trouble from the water within the seal freezing. They are replacing these with iron hoods, and the brick drains by pipe drains. The cost of new catch-basins for the year was about $91 each, and of new manholes $42 to $58.

PRECIPITATION-TANKS FOR LONDON SEWAGE AT BARKING.

THE plans for the treatment of the sewage of London by a precipitation process are now nearly completed. The existing sewage-reservoir at Barking has an area of nine acres, and is divided into four compartments. North of this, precipitation-tanks covering an area of nearly eleven acres are to be constructed.

The *Building News* says: "These tanks form a series of thirteen parallel channels, each thirty-one feet six inches wide, and of an average length of 1,000 feet. They will be constructed of brick and cement, covered over. The sewage will be allowed to enter each tank in succession, so as to give time to allow of the deposit of the suspended matter to take place. Two penstocks are to be provided to each tank, so as to open or shut off communication with the outfall sewer. To facilitate precipitation an admixture of 3.7 grains of lime and 1 grain of protosulphate of iron per gallon is to be made. The effluent will then run away over a falling weir, so arranged that only the top stratum of the liquid will pass over, and the precipitated matter will be left undisturbed. There are to be ten weirs in each of the tanks. Extending transversely under the tanks are culverts for carrying off the effluent into the existing reservoir before discharge into the river, which, of course, will take place when the tide admits. The semi-fluid sludge in the tanks is to be discharged into a collecting culvert, from which it will be conveyed into a sump, and thence pumped into a series of twelve tanks, or sludge-settling channels, near the river, each measuring 140 feet long and twenty feet wide, and covered over. In these the precipitation of the solid matter will be continued, the effluent being drained off over weirs, and conveyed through pipes to the liming station. The sludge is to be discharged through culverts into a sludge store under the tanks, thence it is intended to be lifted and conveyed by pipes to a jetty

on the river to be taken away by ships to sea. The timber jetty is to extend 576 feet into the river. Other auxiliary works in connection with the scheme, such as the liming station, engine and boiler houses, workshops, cottages, etc., are contemplated. The quantity of sewage to be treated is estimated at about 90,000,000 gallons per day, and the quantity of lime per day at twenty-three tons. We may add that the lime for precipitating will be introduced into the outfall sewer about 700 yards above the precipitation tanks, and the protosulphate of iron at a rather less distance.

BRIDGING THE MISSISSIPPI.

In response to a resolution of the Senate calling for information respecting the bridging of the Mississippi at St. Louis, the Secretary of War transmitted in December the report of the Board of U. S. Engineers, consisting of Col. Henry L. Abbott, Major A. Mackenzie, Major A. M. Miller, and Captain E. H. Ruffner.

After hearing arguments in favor of a high bridge without draw and a low bridge with draw, from various parties in interest, they studied the subject in connection with the following physical data: (1) The velocity of the current; (2) the shifting nature of the channel; (3) the volume and velocity below the mouth of the Missouri as compared with that above; (4) the stability of the channel between certain points. They state their conclusions as given below, and we think every unprejudiced engineer will agree with them:

In view of all the data at our command, including the testimony taken before us, surveys and maps of the river, and the observations taken of its current, velocity, discharge, sediment, nature of bed and banks, and from our own personal knowledge and experience of the river itself and its commerce, the board has arrived at the following conclusions:

(1) That while the present bridge across the Mississippi River has not yet been crowded to its full capacity, good reasons are shown for the building of a new bridge above the site of the present one.

(2) Full estimates and a definite location for the bridge were not presented, and its promoters stated that its character would largely depend upon these estimates. The board believes that an exact or even fairly approximate cost of a new bridge, whether high or low, cannot be determined without careful surveys, yet their relative cost can be approximately estimated. From evidence before it, the board is decidedly of the opinion that the increased cost, if any, of a high bridge over that of a low bridge, including erection and operation, has not been shown to be so great as to warrant the conclusion that a low bridge is more desirable than a high bridge, even on the ground of cost alone.

(3) The board has reason to believe that if a draw-bridge were built, it is probable that the channel might at times leave the draw-span and thus make the bridge impassable.

(4) The board calls attention to the fact than an essential feature of the plan of a low bridge is that the channel should be held through the draw-spans. It is not certain that this can be done at all; certainly not without great cost. The matter is not alluded to in the bill itself, nor has it been provided for in any plan or estimate presented or discussed before the board.

(5) The board is decidedly of the opinion that a low bridge with a draw in it should not be authorized or allowed below the mouth of the Missouri River. Such a structure would be a serious and grave obstruction to navigation and a direct and oppressive tax upon all river interests. Justice to navigation interests requires that the proposed bridge should be no greater tax upon the commerce of the river than is absolutely necessary. Channel spans of 500 feet clear width, giving a clear headway of not less than 50 feet at high water, are the least dimensions that should be authorized, and with recent progress in engineering and the introduction of the cantilever principle it is not expecting too much to suggest that spans of even more than 500 feet may be found to be both practicable and economical.

(6) The board desires to emphasize the difference of the Mississippi River above and below the mouth of the Missouri River. Above, it is a quiet river, comparatively free from sediment and drift; the oscillation between high and low water does not exceed about 22 feet. Although low bridges on such a stream are obstructions to navigation, they are not intolerably so. Below the mouth of the Missouri all this is changed. The rise and fall increases to 42 feet at St. Louis and over 50 feet at Cairo; the current doubles in velocity; the volume of sediment is vastly increased; drift frequently runs; the bed is constantly shifting. In a word, the river entirely changes its character, and low bridges must be regarded as an intolerable nuisance to navigation interests.

The Ohio River, which in its lower course resembles the lower Mississippi, is protected by a general bridge law forbidding the construction of low bridges, and, in the judgment of the board, such a law, properly adapted to suit the requirements of the Mississippi below the mouth of the Missouri River, would be useful legislation in view of the ncreasing demand for bridges on the lower Mississippi.

ENGINEERS' CLUB OF PHILADELPHIA.

The club met April 2, President T. M. Cleemann in the chair, thirty-two members and five visitors present.

The following were elected active members of the club: Messrs. Conway H. Day, Lino F. Rondinella, Henry S. Prichard, Eugene A. Rhoads, A. Wells Robinson, George N. Bell, Joseph Powell, Jr., and Griffith W. Jones.

The Secretary presented, for Mr. Theodore Low, "Notes on Railroad Construction."

The paper treats of detail in the management of surveys and plans, forms of note-books, methods of accurate measures for bridge-work, coffer-dams, etc. It embodies many excellent suggestions as to practical details.

Mr. F. W. Whiting, introduced by Mr. L. C. Madeira, Jr., presented a paper upon "The Prevention of the Spreading of Fires," treating especially of the relation of the proper and scientific design and construction of buildings to their safety from entire destruction in case of the starting of a fire within them.

Mr. Francis Lightfoot, introduced by Mr. J. Kay Little, exhibited and described a stamp-splice, tongue and groove rail joint devised by him.

Mr. Max Livingston presented a paper on "Petroleum."

"Petroleum, known and utilized to some extent in different parts of the world since the dawn of history, was found to exist on our continent in 1627. About a century later the first mention is made of its existence in the now famous oil regions of Pennsylvania, where, until 1850, petroleum was collected from the surface of streams and pools in small quantities for medicinal purposes.

"The introduction of shale oil from Scotland directed the attention to our natural oil, and the practicability of its conversion into a purified illuminating oil was readily demonstrated.

"With the increasing demand the problem arose how to increase the production, which was solved by the late E. L. Drake, who, beginning to sink the first artesian oil-well in June, 1859. 'struck oil' the following August at a depth of seventy feet.

"The production of the Pennsylvania oil fields, which during that year may have reached 2,000 barrels, did not fall below 20,000,000 barrels since 1879, and attained the enormous amount of 31,784,190 barrels in 1882.

"Large as the production of oil in the United States is, it is eclipsed by the enormous production of Russia, which would make competition on our part in some of the most important markets of the world impossible, were it not mainly for two reasons—to wit: the superior quality of our oil, and the powerful, sagacious and economical management here. The Russian oil has a much heavier specific gravity than ours, and produces but little naphtha, while our oil yields from ten to twelve per cent. of this desirable material. Russian refiners obtain only thirty per cent. of illuminating oil; we produce upwards of seventy-five per cent. Last, but not least, the residuum from our crude oil is rich in paraffine wax, whereas the Russian oil produces none.

"But all these advantages do not allow us to rest on our laurels. The proximity of the Russian fields to important oil-consuming centres makes the Russian oil a constant menace, which will increase with the increasing facilities for transportation. Within the last year there has been considerable talk of laying a pipe-line (for refined oil) from Baku to the Black Sea, a distance of about six hundred miles. Such a line would certainly lessen the difficulties of transportation. The present state of the petroleum trade, and the prospects for the near future, however, do not justify the consummation of the scheme, which is said to require $10,000,000. Under much more favorable circumstances than those now existing, capitalists could not expect any compensating dividends on their investment."

LONDON (ONTARIO) WATER REPORTS.

The Eighth Annual Report of the Water Commissioners of the city of London, Ontario, for the year ending November 30, 1886, appears at first glance to be quite full and complete, but when one examines it to find out what the actual condition of the works is, it is most disappointing. It appears that the revenue for the year was $41,939.93, and the expense for maintenance was $12,446.37, giving a surplus of $29,493.56, out of which $15,934.24 was paid for extensions of the work and betterments, leaving $13,559.32 surplus. The annual charges of interest and sinking fund amount to $36,432 66, which is raised by general taxation. But while the financial statements are full, the statistical information is very meagre. The engineer and superintendent, Mr. Thomas H. Tracy, incidentally states that there are 250 fire-hydrants, but nothing is said as to the length of pipe in use, the number of services, the number of meters, the average daily consumption of water, and its variation at different seasons of the year, the performance of the pumping-engines, or any other of the fifteen or twenty items that water-works men look for in a report. In the absence of these vitally important data, the condition of the works cannot be commented on, nor any comparisons made as to their efficiency, relatively to the works of towns of the same size. It is to be hoped that next year the commissioners or their engineer will give more statistics. The account of them must be kept, for we notice that all the data are given in Croes's Statistical Tables for 1886, as procured from the Secretary, Mr. Burke.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. III.

(Continued from page 487.)

I doubt whether it is worth considering the philosophy of the question of the cause of circulation in hot-water apparatus very closely. Suffice to say that hot water will ascend and cold descend. This holds good, though, only in water at temperatures above 40° Fah., and therefore holds good for all warming apparatus, but as a question of fact water colder than 40° Fah. will also ascend in a mass slightly warmer than itself, as may be seen in the brine-tank of a refrigerating or ice-making apparatus, where the intensely cold brine leaves the ammonia-pipes and flows upward instead of down, as might naturally be supposed by the person who has not carefully considered the matter.

Mr. T. Bramah, C. E., in an appendix to Mr. Thomas Tredgold's, C. E., Principles of Warming and Ventilation, published in 1806 in London, says: "The circulation of hot water when employed for the purpose of carrying and distributing heat through pipes or other vessels is produced by the unequal density of the fluid arising from the difference of temperature in the ascending and descending columns of water connected with the heating reservoir, and its velocity is governed by the height of the said columns." And to demonstrate more clearly the mechanical action of the moving force by which he considered the circulation is maintained, he inserts the accompanying diagram and reference employed by Mr. Tredgold in a letter to the Secretary of the Horticultural Society, and which was recorded in the transactions of that institution at the time. The passage reads as follows:

"If the vessel (Fig. 4) A B and pipes be filled with water and heat applied to the vessel A, the effect of heat will expand the water in the vessel A and the surface will rise to a higher level *a d*, the former general level surface being *b b*. The density of the fluid in the vessel A will also decrease in consequence of its expansion, but as soon as the column *c d*, above the centre of the pipe, is of greater weight than the column *f e*, above that centre, motion will commence along the upper pipe from A to B and the change this mo-

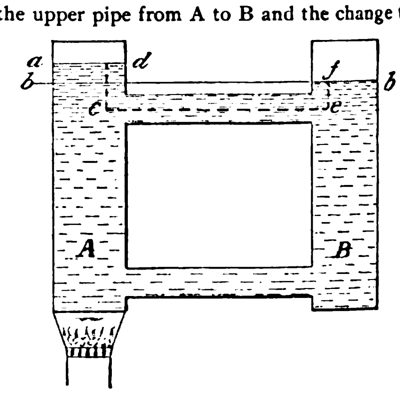


Fig. 4.

tion produces in the equilibrium of the fluid will cause a corresponding motion in the lower pipe from B to A; and in short pipes the motion will be obviously continued till the temperature be nearly the same in both vessels, or if the water be made to boil in A it may be boiling hot in B, because ebullition in A will assist the motion."

Mr. Hood, in his "Treatise on Warming Buildings," takes exception to this, and says: "Now it is certain that this theory will not account for the circulation of the water under all circumstances and in every variety of form of the apparatus, and as the cause of motion must be the same in all cases, any explanation which will not apply universally must necessarily be erroneous."

To prove that Mr. Tredgold was wrong in his assumption, Mr. Hood constructed the diagram, Fig. 5, and said:

"Suppose the apparatus to be filled with cold water and the two stop-cocks to be closed: then, on applying heat to the vessel A, the water it contains will expand in bulk and part of it will flow (run away) through the small waste-pipe *x*, which is so placed as to prevent the water from rising higher in the vessel A than the top of the vessel B." He then asserts that the water which remained in the ves-

sel A after it had been heated and expanded and a portion of it passed away through the overflow-pipe x, as before stated, will be lighter than it was before warming or running

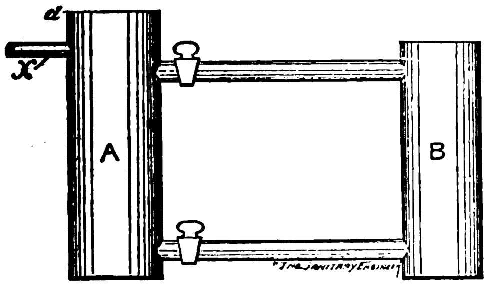


Fig. 5.

off, but that its height remained the same, and then asks the reader to suppose the two cocks to be opened simultaneously and to assume (as assumed by himself) that the hot water in the boiler A will immediately flow through the upper cross-pipe to B, and that the water in B will correspondingly flow toward A through the lower pipe, and evidently wanting the

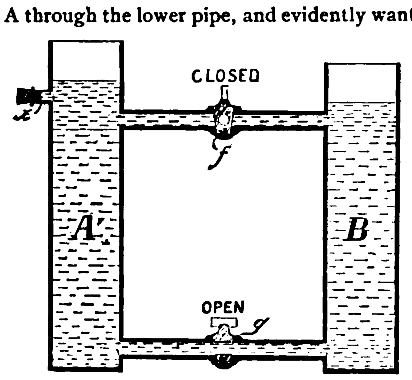


Fig. 6.

reader to agree with him that this flow takes place without the increased head (actual or potential) in the hot leg, arguing that we must find another explanation for the cause of motion, as the reason given by Tredgold "is insufficient to account for the effect in the simplest form of apparatus."

Mr. Tredgold's manner of explaining how the increased height of the warm leg caused the flow is evidently not correct, but his meaning is apparent, and shows that he considered that there was just as much, or more, preponderence of pressure through the upper cross-pipe to B, as there was through the lower pipe to A.

Mr. Hood goes on to explain then that if heat be applied to the boiler A, Fig. 5, an increase of the volume takes place, and that it becomes lighter, the heated particles rising through the colder ones, which latter sink by their greater specific gravity when they in turn become heated like the others (which, of course, is so far correct), and that then, when the water in A becomes lighter than that which is in the opposite vessel (B), the water in the lower horizontal pipe is pressed by the greater weight and

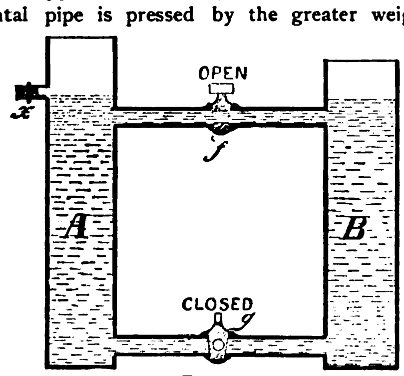


Fig. 7.

moves toward A. A moment's reflection and consideration, however, will show that the pressure through the lower pipe towards A is no greater after the water in A is warmed than it was before, and if the top pipe is removed this becomes very apparent, as no water can pass from A to B, or *vice versa*, without going through the lower pipe, and any one conversant with hydraulics knows this, as there are just as many particles in one vessel as the other, and every particle weighs the same whether it is expanded by heat or not. Mr. Hood, on the other hand, in his treatise, is endeavoring to prove that the motion of the water is caused solely by a force of gravitation in the cold pipe instead of by the force of heat imparted to the water in the warm pipe, and uses some apparently forcible arguments to sustain his theory.

From the practical side of this question it may appear unnecessary to argue this question, and it would be were it not that it will be a means of fixing the cause of motion in the water in the minds of some who have not considered it, and may, presumably, throw some light on the question of difference between the Tredgold theorists and those who follow Mr. Hood, and show that there is really no practical difference between the two men, the fact being simply that they view the question from different standpoints, and that Mr. Hood mistook the effect for the cause, as he by that means more readily explained some of the problems that at first appear to be unexplainable by Mr. Tredgold's views.

If we return to Mr. Hood's diagram Fig. 5 and follow what takes place to the point of getting ready to open the "two cocks simultaneously," we will find that some water has run from the pipe x, and that both cold and hot pipes stand at the same level, though not in hydrostatic equilibrium, as some of the hot column has been drawn away through the pipe x.

Mr. Hood then asks us to open the two cocks together. We do so, and the water circulates we know from past experience. But Mr. Hood must assume for himself, and asks us to assume also, that it circulates without a rise of head in the hot pipe.

This, of course, we cannot agree with if we stop one moment and consider that the hydrostatic equilibrium must be established the moment the cocks are opened, and that we cannot consider the question of a thermo-dynamic circulation to commence until some of the cold and heavy column (B) runs into A through the bottom pipe to establish the balance that was destroyed by running some of the water out at the pipe x, and it is at the commencement of this movement Mr. Hood assumes the circulation is to commence. The first movement of the water commences then, but it is only a hydraulic movement, or circulation, which ends the moment the columns are in hydrostatic equilibrium, and it is at this time the thermo-dynamic current commences that afterwards goes on to keep up the motion of the water in the pipes.

We cannot surely assume that the water in B had anything to do with lifting and discharging some of the water of A through x while the lower pipe was closed, and when the said lower pipe is opened, the upper one being closed, the pressure and current through the lower pipe goes only so far as to establish the balance again; the warm column going up because of its lessened weight—not as high as before, as some of it was run to waste—but relatively as much above the top of the cold column as it was before, and it is then the circulation starts and goes on by the water in the higher level flowing toward the lower one.

Let the reader for himself now make a diagram or a model like Fig. 6, and plug or cork the pipe x and open the lower cock alone (as in Fig. 6) and see what takes place. Why, he will find that the water in A, being lighter than in B (for a given measure of it), will rise again higher than the water in B until they balance in weight. Let him then open the upper cock, closing the bottom one (as shown in Fig. 7), and this head flows through the upper pipe into B, though certainly not pushed there by the weight in B, as *the lower cock is closed*, but by the excess of head in A, above a passage through which it may run off either into B or into an outside vessel, as I will endeavor to show by the diagrams 8 and 9 in my next article.

(To be continued.)

THE NEW YORK TRADE SCHOOLS.

The sixth session of the New York Trade Schools having just come to an end, it is a proper time to give some account of the work of the year.

An extended account of these schools was given in our issue of February 5, 1885, so that it is unnecessary to again give their history, farther than to say that they were founded in 1881 by Colonel Richard T. Auchmuty, of this city, and have since been maintained at his sole cost, for the purpose of giving practical instruction to young men in certain of the trades. Those now represented in the schools are Plumbing, Bricklaying, Stone-cutting, Carpentry, Wood-carving, Fresco-Painting, Plastering. The schools have received the endorsement of several of the trades, as from both the Master and Journeymen Stone Cutters, and from the Master Plumbers. The attendance the past session in the various classes has been as follows:

Plumbing, night class	98
" day class	16
Bricklaying	78
Fresco-Painting	40
Carpentry	24
Stone-cutting	10
Wood-carving	11
Plastering	37

The fame of the schools has now extended over the United States, and at the last session they had young men on the rolls from Missouri, Alabama, Ohio, Massachusetts, Canada, and New York. A new feature in the instruction was adopted to meet the needs of several young men from distant cities, who wished to avail themselves of the instruction in plumbing, but who could hardly afford to spend the entire session here, paying board all that time. So a day plumbing class in manual instruction was formed, these young men attending the school every day for practical instruction, and also hearing the lectures one evening each week. In this way the time required to be spent in the schools was shortened to three months. It is a notable fact that the members of this day class, unlike the majority of the night class, had not already worked as helpers or journeymen, but were taking up the trade of plumbers for the first time, taking this course preparatory to working as helpers.

As indicated above, the work of the schools, being intended for young men, many of whom are at their trades during the day, is carried on at night sessions. The schools furnish all tools and materials. In the plumbing class the school-room is provided with sixty furnaces for melting lead. The necessary heat is obtained from Bunsen gas-burners, which also heat the irons. At cutting sheet-lead, fifteen boys can be put to work at the same time, so that the school has accommodation for seventy-five boys at once from the plumbing class. The size of this class has made it necessary to divide it into two divisions, each of course taking the same course of instruction.

This instruction, in accordance with the purpose of Mr. Auchmuty, is intended to be entirely practical, what a boy wants to fit him as soon as may be to begin to make a living, and start him on the road to becoming a good workman. In the plumbing class the manual instruction treats of the following subjects, and about in the order given:

1. Seams.
2. Overcast joints.
3. Cup-joints.
4. S-traps.
5. Horizontal wiped round joints.
6. Horizontal branch-joints.
7. Upright wiped round joints.
8. Upright branch-joints.
9. Wiping on stop-cocks.
10. Wiping flanges on 2-inch pipe.
11. Wiping on ferrules.
12. Calking.
13. Wiping in bath and sink plugs.
14. Brass pipe bending.

The lecture-course treats of the following topics.

1. Soil-pipes.
2. Trapping and ventilation of soil-pipes.
3. Supply-pipes.
4. Boilers.
5. Tanks.
6. Fixtures.
7. Trapping and ventilation o fixtures.
8. Common mistakes in plumbing.

At the lectures each member of the class is furnished with a printed form of the questions, having a blank space after each question for the answer. The instructor writes the answers on the blackboard and the boys copy them under the appropriate questions on their forms. Each boy is furnished a box, with lock and key, having his name on it. In this box he keeps samples of his work.

The Master Plumbers' Association of this city having recently officially recognized the school as a useful agent in supplying intelligent boys to the trade, a committee was appointed from the association to examine the boys, and give a certificate or diploma to those they thought worthy. This committee (Messrs. Joseph A. Macdonald, James Muir, George Mead, George D. Scott, and Edward Murphy) have examined in all about sixty boys in the night class, the others not having come before them for examination, and the members of the day class. These examinations were, of course, voluntary on the part of the boys, were not announced until shortly before they took place, and undoubtedly some of the boys were afraid to come forward on the short notice, who would have done so had they had longer notice. The committee, however, feel well satisfied at the results of this, the first examination, and it is intended to conduct it each year. The diploma, signed

by the Examining Committee, the founder of the schools and the manager, will entitle the holder to a reduction of the term of apprenticeship. It has been thought best to give diplomas only to those boys who attend the examinations and satisfy the committee of their proficiency, so that the diplomas may become an incentive to the boys to study and pass good examinations.

The school has for several years made exhibits of the work of the boys at the American Institute Fair. We illustrate here some examples of their recent work:

Figure 1, a "water distribution," is the work of a member of the school in the season of 1886, who was at the school about three months.

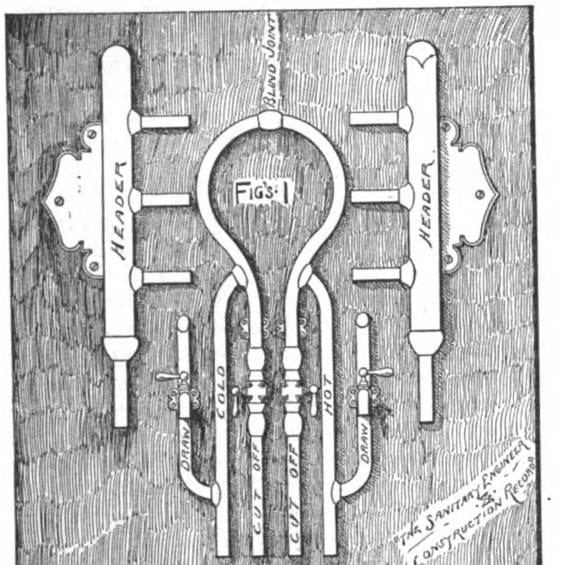


Figure 2 was the work of another member of the class of 1886, who at the time he made it had been about three months at the school. It shows seamed pipe and traps, bottle-traps and waste.

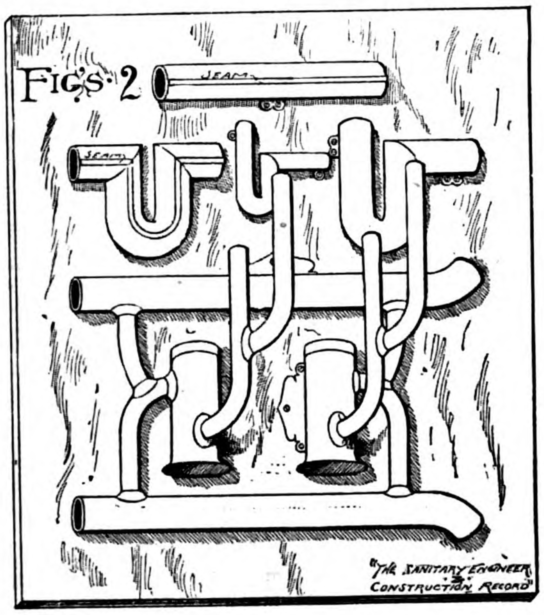


Figure 3, showing seamed trap, bottle-trap, and connections, and header for water distribution, was made by a young man who had been a member of the school, in the season of 1887, for four months.

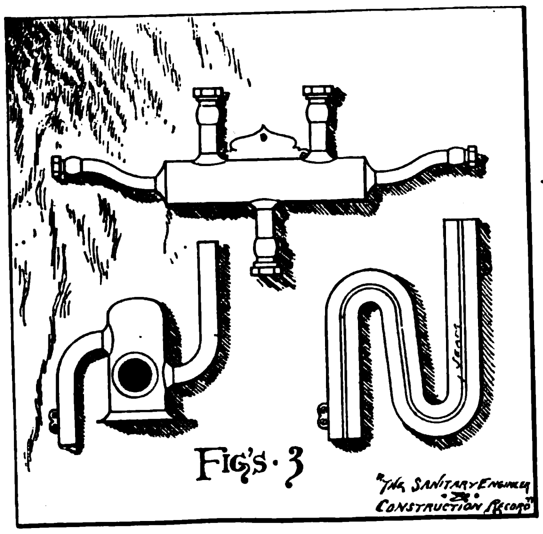


Figure 4, showing the water-supply and cut-off to a fixture, was made by a member of the school in the session of 1887.

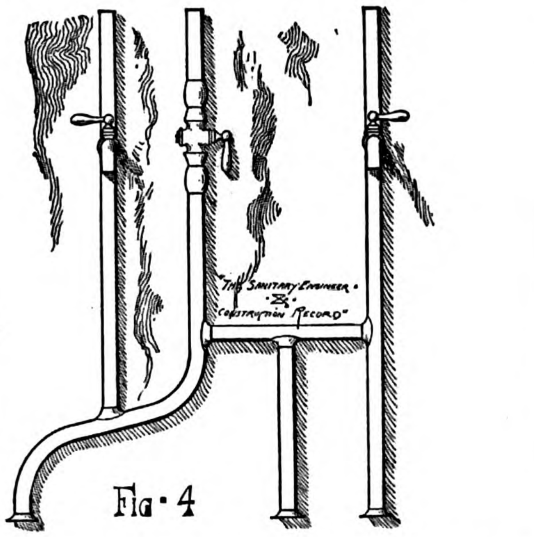
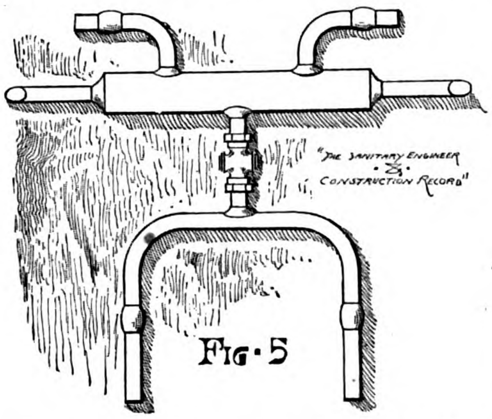


Figure 5, header and water distribution, is the work of a member of the class of 1887, who had attended the school about two months. It required about a day to make.



Lead-burning is now taught at the school, and one of Mr. Thomas Walker's apparatus is used. A description of it at length will be found in our issue of April 5, 1883.

As stated above, the schools were founded by Mr. Richard T. Auchmuty. The Superintendent is Mr. James De Kay; the Lecturer on Plumbing, Mr. Edward Murphy; the Instructor in Practical Handiwork, Mr. James Tennant.

LONDON POLYTECHNIC YOUNG MEN'S CHRISTIAN INSTITUTE.

Examination, May, 1886.

PLUMBERS' WORK.

THE following are the questions referred to by Instructor Clarke in our last issue:

The number of the question to be put before the answer on your paper. Two hours will be allowed, and not more than ten questions to be attempted.

1. Sketch and name the best kind of traps you know of for fixing under a valve water-closet, under a wash-hand basin, and under a pantry sink.

2. Give a sectional elevation of a pantry sink, on the basement floor, showing the trap, waste-pipe, and gulley, or intercepting-trap.

3. Sketch in section a scullery sink, showing how you would trap the waste-pipe, and what provision you would make for preventing grease and sand from passing into the drains.

4. With what object are traps fixed beneath sanitary fittings? How may they be rendered useless for the purpose? Describe what provisions should be made to prevent them being rendered useless.

5. Sketch a water-closet trap, and show where and how you would attach a ventilation-pipe. State in writing how many, and what reasons you have for ventilating water-closet traps.

6. Supposing that instead of ventilating a lead waste-pipe you were to fix two traps in it, the joints being soldered, what would be the result?

7. When fixing horizontal lead service-pipes, why is it important that they should be straight and free from any bagged parts?

8. Calculate as nearly as you can the amount of internal surface of a 9-inch D-trap, and also of a 4-inch round pipe or P-trap. State which trap is kept the cleanest with ordinary water-flushes, and which offers the greatest resistance to loss of seal by syphonage.

9. Sketch and describe what kind of water-closet apparatus you would fix for best use in a mansion and also one for servants' use.

10. Give your opinions as to the advisability of fixing urinals in dwelling-houses. Sketch any kind of water-closet that you know, and show the arrangement of the seat, that can be used as a urinal.

11. Sketch a water-waste-preventing valve for flushing a valve water-closet and fixed beneath the seat; and also one for fixing overhead or above the seat, and describe their action.

12. What is the best material for soil-pipes to be made of? How should the joints be made? Describe all the precautions you know of to be taken when fixing soil-pipes.

13. What size soil-pipe would you fix for one water-closet on the second floor, and what size should the ventilating-pipe be, and what size soil-pipe would you fix for three water-closets, one on first, one on second, and one on third floor?

14. Sketch the three water-closets mentioned in last question, showing the soil-pipe and ventilator, and also the trap ventilation-pipes. Give the sizes of all the pipes used, and describe separately the use of each pipe.

15. Sketch in section a bath on the first floor, showing service and waste valves, waste and overflow pipes, lead safe, and how you would arrange the trapping and disconnection of the waste-pipe.

16. Describe in a brief manner how you would collect, filter, and store rain-water for domestic use in a country mansion. Make your answer clear by illustrations or sketches.

17. Write a short description of the precautions you would take when laying earthenware pipe-drains to take away the sewage from a country mansion which is surrounded by trees and shrubs. The drain has to pass the well which supplies the drinking-water, and has to cross a field, the subsoil of which is loose sand.

18. Describe any drain-pipe you know of with the sockets and ends prepared for fixing without any cement or other luting material.

19. Make a single line sketch plan of any ordinary London terrace-house that you can think of. The drains have to pass through the house to the front street. Show on the plan how you would arrange the drains, also the manholes, drain, and intercepting or gulley traps; where you would fix the air-inlet and upcast ventilation-pipes.

20. Sketch a mica air-inlet valve for drains, also an air-tight manhole cover, and a simple kind of cowl for fixing on the top of the ventilation-pipe.

21. Give a sectional sketch of a disconnecting chamber, trap, etc., as fixed by our best sanitary engineers to cut off the public sewer from the house-drains. The trap to be of a good description.

22. How would you thoroughly test the soundness of the drains inside an empty house? How could you apply and what test would you use to the drains of a house that was in occupation, and the drains could not be opened for examination.

23. A house stands on a piece of ground 100 feet long by 50 feet wide. One inch of rain falls in the space of one hour. The water passes through the drains with a velocity of five feet per second. What is the diameter of the drain?

24. Draw a syphon pipe and describe its action. What is the limit of its power of drawing water?

25. Draw a single-throw lift-pump with an air-vessel in delivery-pipe. How far will it draw water horizontally, and how far vertically? To what height will it lift water?

26. Supposing the above pump was 4 inches in diameter, what should be the size of the suction and delivery pipes? How much water would be pumped in half an hour? The stroke being 9 inches long and worked at 20 strokes per minute.

27. Sketch a section of a high pressure ball-valve, stop-valve, and bibb-valve.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

STEAM PLATE-WARMERS.

NEW YORK, April 4, 1887.

SIR: Will you kindly inform the writer how the ordinary "steam plate-warmers" (with galvanized-iron cases), for use in the butler's pantry, are constructed? Your reply will oblige READER.

[Make a galvanized-iron oven or cabinet of suitable design and convenient size, with shelves for the plates, and near the bottom of it place a coil of steam-pipe.

Several makers of radiators supply the same in ornamental designs in connection with steam-radiators, and at less prices than special ones can be made, even of a plain pattern.]

INODOROUS EXCAVATING APPARATUS WANTED.

NEW YORK, April 18, 1886.

SIR: Can you give us the address of parties who make inodorous excavator apparatus, including wages, etc.?

H. E. SANSON.

[Referred to our readers.]

THE Philadelphia Master Plumbers' Association have adopted a resolution requesting the Board of Health to enforce Section 40 of rules and regulations on house-drainage and plumbing, which requires that plans for plumbing-work to be prepared by the architect of a building and that they be required to have their plans approved before submitting them to plumbers for estimate. It was stated that in a majority of cases this work is now done by the plumber. A resolution was also passed requesting the Philadelphia Chapter of Architects' co-operation in securing the enforcement of this resolution.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
April 16.......... ..	26 53	21.04	21 21	30.54	30.23	25.23	32 91

E. G. LOVE, Ph.D., *Gas Examiner.*

A MEMBER of the Paris Municipality proposes to present the following resolution for the consideration of that body: "A special commission of ten members, of which five are to be elected by the Municipality and five by the Prefectorate, shall be charged with the *immediate* consideration of the best means of establishing a municipal service of electric-light in Paris. This commission shall, as soon as possible, present a scheme for the establishment of central stations both for lighting the public streets and private residences."

THE *Journal für Gasbeleuchtung* contains a description and illustrations of another regenerative gas-burner designed by Mr. F. Siemens. It is of the inverted flame type, and in general appearance somewhat resembles some others of this class. The gas enters an annular space from one of the two side pipes which support the lamp, and descends by several small tubes, the outlets of which form a small ring. The flame is directed downward from this ring, and enters a porcelain chimney which soon enlarges and serves for the removal of the products of combustion. Surrounding the flame is an inverted glass cone which allows some light to pass upward. The height of the cone corresponds very nearly with that of the flame, and is continued below in the form of a hemispherical glass, similar to other lamps of this type.

MR. W. S. RAWSON, in a recent lecture, stated that the efficiency of the Welsbach incandescent gas-lamp was over seven candles per foot of gas. This same lamp has also been tested by Dr. W. Wallace, the Gas Examiner of Glasgow, who finds, as the average of all his tests, 9.73 candles per foot of gas, with a consumption of from 1.85 to 2.42 feet per hour. The Glasgow gas used in these tests gave twenty-four candles for a consumption of five cubic feet.

ACCORDING to *Electrician*, the Court of Appeal at Leipzig has recently enforced a decision annulling several patents taken out in Germany by American inventors on account of the apparatus described not having been manufactured in Germany within the prescribed time.

THE tenth annual meeting of the Western Gas Association will be held at St. Louis, Mo., on the 11th, 12th, and 13th of May. The Southern Hotel will be the headquarters of the association, where special rates have been secured. A. W. Little, of Quincy, Ill., is the Secretary.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

ENTRANCE examinations for applicants for admission to the Massachusetts Institute of Technology have been arranged to be held, for the convenience of the students in the different parts of the United States, at the following cities: New York, Philadelphia, Montreal, P. Q., Chicago, St. Louis, Cincinnati, San Francisco, Washington, Nashville, St. Paul, Atlanta, and Pittsfield. Full particulars may be obtained by addressing, until June 1, Institute of Technology, Boston, Mass.

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

No. VII.

(Continued from page 520.)

DISCUSSION.

J. J. R. CROES, M. Am. Soc. C. E.—I would like to ask Professor Egleston with what kind of mortar he proposed to lay up his oiled stones?

Professor Egleston.—I think any kind of mortar would answer perfectly, because the absorption of oil is not such as to prevent the chemical action in the mortar. The tendency of the oil would rather be to the centre of the stone than to come out and affect the mortar.

M. J. Becker, M. Am. Soc. C. E.—Would this treatment be possible with stones coming fresh from the quarry?

Professor Egleston.—Quite possible. It is desirable, however, that all building stone should be tempered before it is used, that it is left long enough in the air to lose its quarry-water.

J. F. Flagg, M. Am. Soc. C. E.—I would like to ask whether soaking with oil in this way might not interfere with the adhesion of the cement?

Professor Egleston.—I think not.

Mr. Croes.—Certainly it would not prevent the binding of the cement itself, but it seems to me that it would prevent that adhesion of the mortar to the stone which is essential to the mortar and the stone becoming one mass and holding firmly together.

Mr. Flagg.—Would not this treatment of the stone with the oil disfigure its appearance.

Professor Egleston.—There is a difference in the absorption of the oil, and this causes a slight difference in color, which, however, disappears in a few months. If the stone is allowed to remain in oil or in fatty material for months until thoroughly impregnated, it might prevent adhesion of the mortar for a while; but the object is not to soak the stone through, but only to allow it to take up so much oil as to prevent the action of the water from the outside and the dampness from the inside.

Generally the oil is applied after the building is erected, but it is much better to water-proof each block before it is used. The object of it in this case is to prevent any action of the atmosphere; in the other, it is generally to replace the material already dissolved out by some substance, which will fill the pores so left and prevent further attack. The substances so used are oil, sulphur, and paraffine.

F. Collingwood, M. Am. Soc. C. E.—I wish to inquire of Professor Egleston on which side of the building, which exposure he found most decay, and whether the common impression that prevails among masons is correct, that the smooth dressing of stone causes it to be affected more quickly.

Professor Egleston.—There is no doubt that the smooth dressing of stone which has already begun to decompose will make the decomposition go on more rapidly. As to your other point, the direction of the prevailing wind, which regulates the storms, is the one which affects the stone the most.

Mr. Collingwood.—I ask that question because Professor Trowbridge, in an address he made, said that a southerly exposure was the one that damaged the stone the most. He attributed it to the heat.

Professor Egleston.—After the decomposition has taken place in this sandstone, with absorption of moisture in the winter time, there will be a certain amount of freezing, and when the stone is ready to decompose, that will hasten it. I have not followed the researches of Professor Trowbridge, but on the side of prevailing winds, stone always decomposes most rapidly. Decomposition also takes place on the side most exposed to the sun, as the stone is then alternately wet and dry.

Theodore Cooper, M. Am. Soc. C. E.—They have removed from Trinity Church occasionally a stone, and they have redressed numbers of others. Now, what is the reason for that? It is the same kind of stone, is it not?

Professor Egleston.—There are four different kinds of stone in Trinity Church. The contract was only for one, but it was not carried out. When the report of the cause of decay was made to the corporation, it was thought necessary to redress the stone previous to treating it. The decomposition has gone nearly into the interior of the stone, six inches in some cases, and it was found that some of the stones were so rotten that it was not worth while to redress them, and they were removed and new stones put in their place. It is true that stones when they are once dressed and have lost their quarry-water, and then redressed, will not stand as long as stones which are first dressed and then got their quarry hardening. Perhaps the most notable example of this is to be seen in Paris, where the ordinary building stone is easily planed and sawed when first taken from the quarry; but if left long, the plane and the chisel are of little use, and they have to be cut as any other stone.

Oberlin Smith, M. Am. Soc. C. E.—I would like to know whether any experiments have been made by dissolving paraffine oils, which easily evaporate, and therefore get rid of the necessity of heat; and also whether there have been any experiments with ordinary dust with the sand-blast instead of sand.

Professor Egleston.—A large number of experiments have been made with paraffine and like compounds. They have had various results, according to the way the paraffine is applied. Some of them heat the stone in order to make the paraffine enter deeply into it. This is exceedingly dangerous when the stone has commenced to decompose, and is likely to increase rather than diminish the trouble, by causing expansion when the stone is already weak. When the stone is not heated the paraffine must be hot, and the application is best made in warm, dry weather. No substance known has the efficiency of paraffine. It is practically indestructible, and if properly applied, it fills the pores and prevents any subsequent decomposition by the action of the weather. My intention in studying the effect of abrasion, was to take ordinary flour, and my belief was that diamond could be worn away with ordinary flour; but since my first experiments were made, I have never found any one who would allow me to use the sand-blast sufficiently long to test it. I know that this statement seems incredible, but when the difference in hardness between ordinary sea-sand and the diamond is taken into account, and the fact is considered that with ordinary sea-sand the diamond has been worn away, it is quite credible that the stone could be worn away with ordinary street dust, and much softer material. Street dust is much harder than the sand in the ordinary sand-blast. I have frequently made microscopic examinations of the ordinary street dust, and if any of you who live in New York will examine your window-blinds after a rain storm, preceded by high wind, you will find them covered with minute particles of sharp quartz sand. There is also a considerable amount of iron-filings besides organic dust. I believe firmly that if flour is hurled at stone with sufficiently great velocity, in a time easily named it will wear away away the hardest of stone, or even the diamond.

Percival Roberts, M. Am. Soc. C. E.—I recollect a few years ago, in connection with the electric-light machines, that the comminutors, which were warranted not to wear away, were made with hard copper and the brushes with soft. It was found, however, that the comminutors wore away very fast. It was then reversed; the commutors were made of soft copper and the brushes of hard, and the communitors lasted much longer than before. It has also been found that the wear of hard steel rails is greater than the wear of soft steel rails. The fact seems to be that with hard and soft material in connection, the wear of the hard is greater than that of the soft.

Professor Egleston.—I can explain Mr. Roberts' assertion. Any clockmaker sees these facts. The diamond saw is made of the softest copper that can be had. The fact of this wearing and cutting action can be seen in any old-fashioned clock escapement. The soft brass of which the escape-wheel is made, frequently remains unacted on for 125 or 130 years, but the hard steel of the escapement is cut into so far as frequently to have the appearance of having been carefully filed. I recently made an examination of a clock of this kind, the escapement of which was deeply worn and the pinions of the escape-wheel almost entirely cut through. The fact is that the soft material with the gummy oil holds the hard dust, as the copper of the diamond-saw holds the diamond dust, and in this way grinds into the surface sometimes as far as one-sixteenth of an inch.

Frederick Brooks, M. Am. Soc. C. E.—I would like to inquire what was the intention in painting the stone of the Capitol at Washington?

Professor Egleston.—I think the original intention was only to make the old part agree with the new in color, but the oil of the paint preserved the stone from the action of the air, and it has since been used for that purpose.

Mr. Flagg.—It was in such a bad condition that it was the only way to give it a respectable appearance.

Mendes Cohen, M. Am. Soc. C. E.—I have always heard that the first painting was done to the Capitol to restore the white surfaces that were destroyed with smoke in 1813.

Charles B. Brush, M. Am. Soc. C. E.—Does not this treatment shut up quarry-water in the stone, and is it not therefore injurious to the stone?

Professor Egleston.—The quarry-water is very small in amount in the stone, and evaporates after an exposure of only a few months. The experience in the English Houses of Parliament was, that unless the stones were treated on their six faces, they would flake and chip, as if they had not been treated, in the course of a very short time. The only thing that has stood is sulphur. Applications made to the exterior of the stone did not answer except the sulphur. The stone treated with sulphur lasted thirty or forty years and has only just begun to flake. Paraffine has, to my knowledge, never been used on the House of Commons. If any of the processes that require the stone to be heated were used on that building they would do great harm.

W. H. Bixby, M. Am. Soc. C. E.—I would like to know the effect of applying boiled linseed oil to marbles and other light materials?

Prof. Egleston.—It is not generally applied to marbles at all. Its object is to replace something dissolved out. It darkens stones.

William P. Shinn, M. Am. Soc. C. E.—The Pittsburg Court-House, built in 1848, was built of Freeport sandstone. The columns, which were doric, I think, were painted immediately after they were erected. The result was a scaling of one-eighth to three-sixteenths of an inch off the whole surface of the columns, leaving them rough. I was not in Pittsburg at the time the painting was done. The first time I saw the Court-House was some five or six years afterwards. The stone-mason who erected it was a contractor under me in the construction of the Fort Wayne road, and stated, as his opinion, that the cause of the scaling was that the paint was put on before the evaporation of the quarry-water. I do not know as to his theory being

*A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

correct, but I do know as to the scaling, and that the paint was put on immediately after the erection of the stone.

Mr. Becker.—This stone is found in the neighborhood of Pittsburg. It is a soft, oleaginous sandstone, and, while wearing but slowly, it soon shows unmistakable signs of decay from water and the elements. But that stone contains so large an amount of quarry-water that it is impossible to use it fresh from the quarry. The stone has to be seasoned from four to six months. If the stone is laid into the work direct from the quarry it will crack from frost, and I should think that stone containing such a large amount of water should have some treatment to eliminate that moisture before the remedy against decay is applied,

Prof. Egleston.—It certainly should. That amount is unusual.

(TO BE CONTINUED.)

MEETING OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE evening was devoted to the continuance of the discussion on Mr. Metcalf's paper on "Steel: Some of Its Properties, Its Use in Structures and Heavy Guns."

Mr. D. J. Whittemore dwelt on the loss of ten per cent. of strength experienced through shop manipulation.

Commander C. F. Goodrich believes in the new guns and gave his reasons.

Lieutenant Barber thought Mr. Metcalf should be listened to because he combined shop practice and theory in his experience. High ductility in steel for guns is not necessary—at least, its necessity is not proven. The Terre Noire experiments did not test the method of manufacture by casting. Nevertheless, the making of solid castings had been as yet problematical. He went into statistics as to failure of cast guns, and claimed the built-up guns and all other improvements in gunnery to be as much American as English.

Lieutenant R. R. Ingersoll said that the principle of initial exterior tension must be retained, and discussed effect of annealing a cast gun, etc.

Lieutenant Austin M. Knight stated that in fourteen years ten built-up guns had failed out of the large number in use, and claimed that we cannot afford to lose time, even if by long experimenting a better or cheaper gun can be obtained by casting.

Mr. William Sellers doubts whether solid guns are the guns of the future. He pointed to the possible expensiveness of making successful castings, and of the great cost of disposing of the material of the unsuccessful ones.

Mr. Charles A. Marshall discussed the question of pressures, and the chemical and physical effect of quick or slow cooling of masses of steel.

Mr. Henry M. Howe claimed that the rule-of-three process does not apply to the parts of built-up guns, and that they do not necessarily have the same strength as the test-pieces. For example, a six-inch diameter steel shaft forty feet long broke at 30,000 pounds per square inch tensile strength, and a specimen cut from the centre adjacent to the ruptured portion bore 100,000 pounds.

Mr. A. E. Hunt gave some interesting tests of material confirming some of Mr. Metcalf's statements, especially that the steel always registers the heat to which it has been exp sed, etc.

Mr. John Coffin discussed the two forms in which carbon exists in steel, and spoke of the difficulties in the way of making cast guns on the Rodman principle.

Professor J. W. Langley spoke of the carbides of steel as presenting the problem of viscid fluids, etc.

Mr. M. J. Beecher spoke of the tendency in bridge-work to abandon cast iron for cast steel, and asked whether Mr. Metcalf would recommend it, to which the latter replied he *would*, and use "dead soft" steel.

Professor W. M. Burr said that 65,000-lb. steel had 40,000 lbs. elastic limit and 80,000-lb. steel had 45 to 48,000 in compression.

Mr. A. Gottlieb does not think steel a liquid, and considers it a treacherous material.

Mr. Joseph M. Wilson and Mr. Samuel T. Wagner gave some interesting items.

Mr. Percival Roberts said heat was the greatest factor in either making or spoiling steel, and considered that the engineer might properly specify against phosphorus, but should leave tests by samples to the manufacturer, and confine his own tests to the finished product in its final shape; drop or blow tests being most important.

L. L. Buck claimed that a succession of rings shrunk on one after another did *not* give a progressive strain from tension outside, changing uniformly to compression inside.

There was then a verbal discussion between Messrs. Brinckerhoof, Michaelis, Cooper, Worthen, Morrison, and Collingwood.

It was announced that it had been decided to hold the annual summer meeting at the Hotel Kaaterskill, in the Catskills, stopping at West Point and the site of the new Poughkeepsie bridge en route.

BOSTON SOCIETY OF CIVIL ENGINEERS.

THE regular meeting of the Boston Society of Civil Engineers, Mr. L. Fred Rice, President, in the chair, was held on the evening of April 20. Fifty-one members and seven visitors were present.

Professor George F. Swain, of the Institute of Technology, gave a talk on "Details of Iron-Bridge Work," and exhibited drawings and blue prints of different bridge works; also, photographs of the Bussey Bridge disaster, and, by permission of the Massachusetts Railroad Commissioners, he showed the different hangers taken from the Bussey Bridge on the Boston and Providence Railroad.

PERSONAL.

MR. JOHN W. HENION, for the last five years superintendent of the Minneapolis, Minn., Water-Works, has resigned.

MR. FRED J. H. RICKON was unanimously elected City Engineer of the city of Little Rock, Ark., for the third term.

JAMES ROBERTSON THOMPSON, senior member of the Jersey City, N. J., Steel Company, died in this city, April 18, in the sixty-fifth year of his age.

MR. JOSEPH DANIELS, of the firm of Smith & Daniels, architects, Cleveland, O., will leave for Europe May 14 to be absent during the summer.

MR. R. H. ROBERTSON, architect, of this city, sailed this week for a two months' trip abroad.

R. ADAMS DAVY has been appointed Chief Engineer of the Temiscouata Railway, Quebec, Canada. This railway, eighty-two miles long, forms a short line connection between the Intercolonial Railway at R. du Loup and the New Brunswick Railway at Edmundston.

T. H. SPENCE, of Lacrosse, Wis., has been elected President of the Wisconsin State Board of Pharmacy.

ALEXANDER MITCHELL, President of the Chicago, Milwaukee and St. Paul Railroad, died in this city, April 19, in the seventieth year of his age.

THE widow of the late J. Morgan Slade, of this city, has presented to the General Society of Mechanics and Tradesmen the collection of works on art and architecture made by her husband.

MR. W. K. BURTON, C. E., late Engineer to the London Protective Sanitary Association, is en route to Tokio, Japan, to take the position of Professor of Sanitary Engineering at the Imperial University.

TOO LATE FOR CLASSIFICATION.

BUILDING INTELLIGENCE.

CHICAGO.—532 N State, br dwell; cost $12,000; o, F S Chard.

410 Oak, br flat; cost, $10,000; o, P J Doyle; a, C H Gottig.

1185-87 Milwaukee av, brick store and flats; cost, 14,000; o, J F Guth; a, Otto Struck; b, John Held.

291-95 Douglas av, br store and hall; cost, $16,000; o, Mrs H Byrne; a, Cleaveland & Chapman.

233-237 Jackson, b s bldg; cost, $22,000; o, estate of W S Johnston; a, S M Randolph.

231 Jackson, br stores; cost, $12,000: o, Mrs E S Fabian; a, S M Randolph.

269 La Salle av, 3-story dwell; cost, $10,000; o, Dr Fenger; b, Robinson & Miner.

465-67 Van Buren, brick store and flats; cost, $20,000; o, Wm Borden; b, C Busbey.

CHICAGO, ILL.—N e cor Washington and Franklin, 5-story s and br office bldg; cost, $70,000; o, Chicago Telephone Co; a, J L Silsbee; b, not let.

Ellis av, br and s houses; cost, $25,000; o, Miss C Cook; a, Enders & Warneke.

242-4 Newberry av, br factory; cost, $18,000; o, J M Williams; a, T V Wadskier.

E North av, br hall bldg of 4-story; cost, $70,000; o, Gondorf Bros; a, Z Ahlschlager.

3230 Michigan av, br dwell; cost, $18,000; o, C H Blair; a, E Baumann; b, John Griffiths.

351-59 S Ashland av, 5 3-story dwells; cost, $30,000; o, Wm Frost & Bros; a, Jenney & Otis.

CAMBRIDGE, MASS.—Harwood College will build a swimming-bath to cost $75,000. Plans have been drawn.

CLEVELAND, O.—The Cleveland Rolling-Mill Company will build this season a new blast-furnace costing over $200,000. All buildings will be of brick and iron. The stack will be eighty feet high. A new engine will also be furnished.

Mr. Clarence O. Arey, architect and engineer, has prepared plans for the Home for Incurables, to cost about $10,000; also a fine residence for Dr. H. C. Haydn, on Euclid avenue, to cost $12,000.

CHATTANOOGA, TENN.—Address W. G. McAdoo about a building for a tool factory, to be built here.

CLEVELAND, O.—M J Eisenmann, architect, has a block in course of construction for M A Hanna, costing $23,000.

CLEVELAND, O.—Address Myron T. Herrick about the arcade to be built here by a stock company with a capital of $600,000. Plans are being drawn.

CRESTON, IA. — It is proposed to build a $35,000 city building here.

CARTHAGE, MO.—George B. Wood has the contract for building the new college building of the Collegiate Institute.

CAMDEN, ME.—Incorporated April 16 was the Camden Woolen Mill Company, to build Gould's Mills. W G Alden is President.

CEDARTOWN, GEO.—A $10,000 schoolhouse will be built here.

FALL RIVER, MASS.—A large mill will be built here on Bay Street, for cotton goods. Plans are now being made.

FRESNO, CAL.—The Fresno Hotel Association wants bids, until April 30, for building its hotel building. Bonds in $30,000 are required. T E Hughes is President of the association.

FULTON, MO.—W R Rhodes, Superintendent of the Missouri State Lunatic Asylum here, will receive proposals, until May 10, for work on the buildings.

HARRISBURG, PA.—It is likely a State Library Building, to cost about $550,000 will be built. A bill providing for it has just passed the House. A commission headed by the Governor is named to have charge of the construction.

INDIAN ORCHARD, MASS.—Br foundry; cost, $10,500; o and a, Chapman Valve Co; a, Darling Bros.

MINNEAPOLIS.—Centennary Church will erect a new building to cost probably $100,000.

ST. PAUL.—Ducas, near Susan, 2-story br block, stores and offices; cost, $14,000; o, P Martin.

Chicago av, near Dakota, 3-story br block; cost, $14,000; o, J Heisinger.

E Third, near Maple, 2-story br block; cost, $12,000; o, M Lethauser.

Payne, near Reaney, 2-story br stores and dwells; cost, $7,000; o, J M Truneth.

Robie, near Ada, 1-story fr church; cost, $7,000; o, Trinity Eng Luth Church.

Jackson, near 7th, 6-story br block; cost, $70,000; o, D Schutte.

108 additional permits, aggregating $111,200.

SPRINGFIELD, MO.—It is said that a County Court-House and jail, to cost $100,000, will be built here.

STILLWATER, MINN.—Ascension Church will build an edifice to cost $10,000.

SOUTH ST. PAUL, MINN.—Hamilton & Turner are architects for five school-houses here.

SHEFFIELD, ALA.—Mr. L. B. Wheeler, architect, of Atlanta, Geo., has completed plans for a bank building for the First National Bank, C. D. Woodson, President.

WASHINGTON.—1607 28th st, 3-story br bldg; cost, $7,500; o, D Rittenhouse; a, G W Done & Co

1219 Mass av, 3-story br bldg; cost, $11,000; o, T A Lambert; a, Phelps & Atkinson.

1455 R I av, 3-story br bldg; cost, $12,000; o, E B C Rogers; a, W P Lipscomb.

1443 R I av, 3-story br bldg; cost, $12,500; o and a, J R Pellings.

1810, 11½ and 12 C st, 3 2-story br bldgs; cost, $7,000; o, Kate Ross; a, J Germuller.

22d, bet Va av and F, 5 2-story br bldgs; cost, $13,000; o, Dr. Geo Kleptine; a, B. F. Price.

1310-14 29th st, 3 2-story br bldgs; cost, $15,000; o and a, Jno McDaniel.

1748 P st, N W, 3-story br bldg; cost, $8,000; o, G W Barleige; a, J B Williamson.

1710 G st, N W, 3-story br bldg; cost, $8,600; o, Charles Klotz; a, Daniel Driscoll.

1628 K st, N W, 3-story br bldg; cost, $11,000; o, J M Johnson; a, Owen Donelly.

1331 R st, N W, 3-story br bldg; cost, $11,000; o, J S Pugh; a, R T Taylor.

1744 K st, N W, 3-story br bldg; cost, $10,500; o, B Haden; a, R R Taylor.

1532-34 14th st, 2 2-story br bldgs; cost, $8,000, o, C D Leberman; a, Emmett & Heisley.

50 permits less than $5,000.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.*

For works for which proposals are requested, see also the "Proposal Column," pages 539-540.

WATER, SEWERAGE, ETC.

BROCKTON, MASS., Aldermen have passed an order appropriating $15,000 to the extension of water-mains.

OLNEY, ILL., wants water-works.

MOUNT CLEMENS, MICH., is discussing water-works.

KEARNEY, N. J., will have a water-supply.

VALLEY FALLS, KAN.—Address R. E. Van Meter, Secretary of the Board of Trade, about water-works here.

THE Oswego, Kan., Water-Supply Company has been incorporated. F. T. Greene and N. A. English, of Wichita, may be addressed.

CICERO, ILL.—This suburb of Chicago will lay a $30,000 box-sewer. It shall be 19,600 feet long and from 36 to 40 inches square; manholes every 400 feet.

SUMTER, S. C., is receiving propositions for water-works. On April 15 Charles A. Hague and Rufus C. Barkly, of Charleston, S. C., offered to erect pumping-engines of 2,000,000 gallons daily capacity, a stand-pipe 5x80 feet, with mains and forty hydrants, for $2,000 annually; new hydrants or mains already laid, $50 annually; on new lines of mains, $75 annually; the city to have right to buy after thirty years; the franchise to run ninety-nine years. The City Council will probably, it is reported, accept this proposition and work will be begun at once.

LOCKPORT, N Y., will move its pumping-station and erect new works.

CANTON, N. Y.—Sewers are soon to be put in here on the separate system, from plans of E. W. Bowditch, C. E., of Boston.

CHATTANOOGA, TENN.—Just organized is a new water company, "The Mission Ridge and Chattanooga Water Company," to furnish a supply of water from Green's Lake on Mission Ridge. John A. Hart, W. W. Grant, and others, are incorporators.

MONTCLAIR, N. J.—The test well for water-supply is completed, and pumping-engines will be erected at once.

WORCESTER, MASS.—The report of City Engineer Allen on disposal of the city's sewage was presented to the City Council April 18. Mr. Allen favors converting Mill Brook into a sewage-conduit, and the construction of precipitation works at the outfall. The estimate of cost is as follows: Separate conduit for the waters of Mill Brook, $133,164; outfall sewers from Mill Brook to the precipitation works, $55,775; buildings, tanks, and machinery, $60,000; contingencies, $37,190; total for works, $285,129.

DARLINGTON, WIS. — The Darlington water-works system will be extended immediately.

LEBANON, MO., has a water company just organized to supply the town with water.

BROOKLYN.—The appropriations asked for by the Department of City Works, include 15 miles of water-mains.

GREENSBURG, PA.—On April 15 the Board of Burgesses adopted the proposition of the Westmoreland Water Company to provide a supply of water, and to furnish 35 hydrants at $50 each annually. The works are estimated to cost about $150,000. The source of supply is on Chestnut Ridge, near Lyceppus, about ten miles from here. The company proposes to erect three reservoirs, the largest and main one having a capacity of 7,000,000 gallons. The company is composed of Senator Meredith and James McCullogh, of Kittanning, and capitalists of Greensburg. Work will begin in May.

GRAND RAPIDS, MICH.—The citizens' committee on water-supply will report very soon. A survey of probable sources has been made. Look out for proposals.

PORTSMOUTH, VA.—The Purchasing Committee of the new water company is Judge Hines, President; J. Trevitt Pike, Secretary; and two others. Mr. W. E. Worthen, of New York, has made surveys for extensions of the works. Operations will be begun at once.

SEATTLE, W. T.—The Spring Hill Water Company will begin work at once on the reservoir in South Seattle.

COLUMBUS, O. — Secretary Filler, of the Water Board, estimates that $58,561 will be required the coming year for extensions and improvements of the water-works.

JANESVILLE, WIS.—Address Mayor Winans in regard to erecting water-works here. Steps will be taken at once to obtain propositions.

HEMPSTEAD, L. I., has refused the application of Taylor & Co., for permission to lay water-mains in the streets, also the application of James Gamble for a franchise for a water company.

ENGLEWOOD, N. J.—Contractor Tierney, of Hoboken, is laying a 30-inch main from pumping-station at New Milford, through Englewood, to Ridgefield, to connect with the old main at Ridgefield. The extension will be twelve miles long, with a tap at Englewood to furnish a reservoir with water, from which the town will be supplied. The forty-five hydrants will be placed on the extension in Englewood. The entire cost is $300,000. Already eight miles of pipe have been laid and the work will be completed by October 1. A system is also anticipated to put water to the top of the Palisades. The committee who have the present extension in charge have been appointed to consider the question of an improved system of sewerage.

LENOX, MASS.—An intercepting sewer is to be built here, and also a new outfall and sewage irrigation-field from plans of E. W. Bowditch, C. E., Boston.

GLENWOOD, COL., has made a contract with the Crystal Springs Water Company to supply water for a population of 50,000. The source is No Name Creek.

CRESTON, IA., Water Company was incorporated April 13; incorporators John Gamble, O. Q. Holman, A. E. Keith, and H. Kingston Leonard.

PALMYRA, N. Y., wants water-works. Address Mr. Averill, office of the *Courier*, for further information.

DALTON, GEO., is said to be a good field for water-works projectors, as their construction is now being agitated, and their necessity is apparent to the citizens.

THE Queens County Board of Supervisors has ordered the laying of an 8-inch water-main from Far Rockaway to and along Rockaway Beach.

OLD ORCHARD, ME., citizens are negotiating for water-works, to be built this year. It is proposed to take water from Phillips' Spring. The estimated cost of the works is $40,000. A town meeting will be held in a few days.

FOSTORIA, O.—The Fostoria Water Company was incorporated April 18, with a capital of $100,000.

GENESEO, N. Y.—The contract for digging the ditch, laying the pipe, constructing the reservoir, putting in the pumping apparatus at the lake and the hydrants at the village for the Geneseo Water-Works has been let by the Board of Water Commissioners to Koon & Mooney, of Kingston, Pa. The bid was $23,644.88, the work to be done by September 1.

KOKOMO, IND., has accepted the proposition of the American Waters-Work Company to lay eight miles of water-mains, and place 120 hydrants, at $3,400 per year, and additional hydrants, $30 per year each.

ATTLEBORO MASS.—Water-works projectors should look out for propositions for water-works here. The committee on obtaining a supply is ready to report.

ELGIN, ILL.—Address the Water-Works Commission about prospective enlargement of water-works here.

MILFORD, MASS.—On April 17 the Water Committee voted that the town should purchase the works and franchise of the Milford Water Company.

ELLENVILLE, N. Y., has just been given authority by the State Legislature to expend $16,000 in extending the water-supply system.

PHILADELPHIA, PA.—Sewers, to cost $150,000, will be built. Mr. Thornton, Chairman of the Survey Committee of Councils, has the matter in charge.

WASHINGTON, D. C.—Sewers, to cost $50,000, are to be built here. Captain T. W. Symons, of Engineer Department, may be addressed for further information. Captain Symons is at work on the plans.

JAMAICA, L. I.—The village has awarded the contract for furnishing a supply of water to John Lockwood for $2,000 annually. A pumping-station will be built.

MARBLEHEAD, MASS.—On April 20 town meeting voted to raise $42,000 to lay water-mains. Water commissioners were chosen April 21.

BATON ROUGE, LA., has contracted with C. A. Lamb and H. S. Raymond, of Chicago, to build water-works.

GAS, STEAM, BUILDINGS, ETC.

STEAM BOILERS.—See our Proposal Column for steam-boilers wanted by the Boston Water Board.

MOBILE, ALA.—Bids for lighting the city were ordered readvertised for by the General Council. They were opened yesterday.

GALVESTON, TEX., has readvertised for bids for lighting the city.

TROY, N. Y.—Bids for lighting the streets were opened April 15. The Troy Electric-Light Company bid fifty cents a light. The Troy Gas-Light Company offered to light the entire city, 800 lamps, at $22,000 a year, or to light 200 lamps, four-foot burners, at eleven cents a lamp. The bid of the Troy Citizens' Gas-Light Co. was for 200 lamps at twelve cents a lamp. The Troy Gas-Light Company's bid for gas for the city buildings was $1.75 per 1,000 feet, and the Citizens' Gas-Light Co.'s bid was the same. The consideration of the bids for street lighting was postponed.

GAS COMPANIES.—Incorporated in Ohio are the Alaska Oil and Natural-Gas Company, of Fulton County, the Fostoria Gas-Fuel Company, and the Greenfield Natural-Gas and Oil Company.

ORGANIZED is the Dayton, Tenn., Gas and Oil Company to bore for natural-gas and oil. Address M. A. Farrell, at Dayton.

NILES, O.—This town will be lighted by electricity.

FULTON, N. Y.—The Village Board has made a contract with the Thomson-Houston Electric-Light Company to furnish forty arc-lights for the streets at $1,500 per year.

DENVER, COL.—Gas works will be built here by the People's Gas-Light Company, of St. Louis, Mo. Dennis Sullivan, of Denver, may be addressed.

ORGANIZED is the Canton, O., Oil and Gas Company to bore wells and furnish natural-gas. Work will be begun at once.

AKRON, O., is organizing a company to bore gas-wells and pipe gas to the city.

GAS-WORKS.—Gas-works projectors will be interested in learning that, on May 16, the gas-works of the Columbus, Miss., Gas-Light and Coke Company will be sold at public sale by E. Gross and George A. Evans, Commissioners, under decree of the Court of Chancery.

PLANS WANTED.—Plans, in competition, for the Jefferson County, Ala., Court-house will be received by M. T. Porter, Judge of Probate, Birmingham, Ala., until May 16. The cost is limited to $40,000.

TOLEDO, O.—A correspondent writes: Developments in the new oil and gas field of north-western Ohio having been going forward recently at a rapid rate, and new wells coming in daily seem to be extending the territory in many directions, and into hitherto unexpected quarters. Among the most important additions are very strong flowing gas-wells which have been struck at Genoa and Bryan, a short distance east and west of Toledo respectively. The two pipe-lines from the Wood County field are nearly completed to this city, and large gangs of men are at work laying the pipes through the streets, so that the natural-gas can be introduced within a few weeks. The plumbers here are expecting a great boom in their business, in fitting up houses and factories, and making the connections.

RAILROADS, BRIDGES, CANALS.

INCORPORATED is the Far Rockaway, Long Island Railroad Company, to build a road to Far Rockaway Inlet; G. E. Bulmer, Anthony Miller, Benjamin Hants and other are incorporators.

Also the Fulton Street Crosstown Railway Company, of New York City. Charles M. Day, of Brooklyn, is an incorporator.

SELMA, ALA.—A railroad will be built from Selma to St. Andrew's Bay, Florida. Address A. G. Parrish, City National Bank, Selma.

LIMA, O.—Superintendent Neilson and John Corlise, of the Cincinnati, Hamilton and Dayton Railroad, Judson Harmon and Major Feichmeyer, of Cincinnati, and J. B. Townsend, of Lima, are interested in the projection of a new belt line railroad to be built around the city. The capital invested is $100,000.

THE contract for the graduation, masonry, tunnel work, timber work, track-laying and ballasting of the Dresden Branch, Cleveland, Akron and Columbus Railway Company, has been awarded to Messrs. Paige, Carey & Co. of Akron, O.

SAN FRANCISCO, CAL.—The Harbor Commissioners want bids for the construction of a sea-wall 1,000 feet long, to cost about $135,000.

Bids for the sea-wall will be received until May 12. The estimate of quantities includes 112,400 tons of stone and 88,900 cubic yards of sand.

BRIDGE.—Bridge builders should address bids to John R. Dillon, Clerk of Chatham County, Georgia, until May 10, for a bridge on the Isle of Hope Causeway. Mr. Dillon's address is, Office of County Commissioners, Savannah, Geo.

MANSFIELD, O.—Messrs. M. Van Rensselaer and Sumner J. Dunham, of New York, and H. Brown, of Mansfield, are interested in the projection of a new electric street railroad to be built the coming season.

LIMA, O.—The Columbus, Lima and North-western Railroad Company has been organized with a capital of $20,000. The road will be built at once.

INCORPORATED is the Rock Island, Dodge City and Denver Railroad Company, Dodge City, Kan., is the principal office. Address George M. Hooser, of that place.

ORGANIZED is the Hastings, Minn., Omnibus and Street Railroad Company; R. C. Libbey, Dennis Follott & Co.

RAILROAD. — Incorporated is the Grouse Creek Railroad Company, in Kansas, to build from the Denver, Memphis, and Atlantic Railroad to Arkansas City. Address J. L. Huey, of Arkansas City.

RAILROAD EXTENSION.—It is reported that the Atchison, Topeka, and Santa Fe Railroad has bought $945,000 worth of steel rails for extending its road from Mojave to San Francisco. The surveys for the entrance into the city have been made, and the site for the depot and freight-houses selected.

WEBSTER COUNTY, NEB., will receive bids for a bridge across the Republican River, of three spans, of Pratt truss, 120 feet each, roadway 16 feet in clear, of not less than 1,280 pounds per lineal foot roadway capacity, until April 30. Address Mr. Charles Gust, at Red Cloud, Neb.

RAILROAD.—The Harrisville, Grantsville and Charleston Railway Company, capital stock $25,000, has been chartered to build a railroad from Harrisville to Charleston by Thomas E. Davis, J. M. Heaton, and others.

INCORPORATED is the San Juan Railway Company to connect with the Denver, Rio Grande Railroad at Durango. The principal office is at Denver. Edward R. Murphy, Joseph W. Gilluly, and others are incorporators.

FLORIDA Southern Railroad Company is preparing to build from Leesburg to Barlow.

INCORPORATED is the Walla Walla and Puget Sound Railway, of Walla Walla. J. F. Boyer, Orley Hill, J. M. Cornwall, and others.

NEW HAVEN, CONN.—It is said a $10,000 iron bridge will be built in East Rock Park.

BIDS OPENED.

OTTAWA, CAN.—Smead Dodd & Co., of Toronto, will put steam-heating apparatus into the Wellington School at $1,800.

STEEL CONTRACT.—The contract for steel armor-plates and steel gun-forgings has been awarded by the Secretary of the Navy to the Bethlehem Iron Company, of Bethlehem, Pa. The bids were published in our issue of March 26.

BRIDGE.—The contract for a bridge over Silver Creek, Ind., for the New Albany and Eastern Railroad, has been awarded to Crumb & Mulcher, of New Albany.

BRIDGE.—The Atlanta, Geo., Bridge and Axle Company has the contract to build a bridge at Rome, Geo. It will have two fixed spans of 71 feet each and a draw span of 185 feet; price, $17,000.

CHICAGO—E W Blatchford & Co. will supply the city with pig-lead at $4.20 per cwt.

NEW YORK.—Bids for building the new Gansevoort Market were opened at the Department of Public Works on April 18 and resulted as follows:

B. Sheridan, $553,000; Moran & Armstrong, $477,443; F. Agnew, $497,777; J. McQuade, $485,000; John Moore, $495,980; D. C. Week & Son, $574,885; J. H. Brady, $499,300; B. Gallagher, $486,500; John Cox & Co., $548,000; J. H. O'Rourke, $547,845.

The bid of Moran & Armstrong being the lowest it was transmitted to the commission for examination of sureties.

MANKATO, MINN.—W. B. Craig has been awarded the contract for a portion of the outside work on the Court-House for $15,800.

GOVERNMENT WORK.

WASHINGTON, D. C.—Proposals for furnishing terra-cotta pipe and braches, opened April 20, by the Engineer Commissioner: ALamond bid for 12,000 feet 8-inch pipe, 11½ cents; 25,000 feet 12-inch pipe, 21 cents; 12x6 branches, 39 cents; 6-inch thimbles, 10 cents. Potomac Terra-Cotta Company, 10½c. 8-inch pipe, 21 cents 12-inch pipe, 30 cents 15-inch pipe, $1.20 24-inch pipe; 8x6 branches, 35 cents 12x6, 36 cents, 24x6 $2; 6-inch thimbles, 10 cents. American Sewer-Pipe Company, 8-inch pipe 10 cents, 12-inch pipe 16 cents, 15-inch pipe, 25 cents, 24-inch pipe $1.30; 8x6 branches, 17 cents, 12x6 branches 32 cents, 24x6 $2.50.

COLUMBUS, O.—Synopsis of bids for iron-work of mail platform, etc., for Court-House and Post-Office, opened April 15, 1887, by Supervising Architect of the Treasury Department: M. D. Krumm, 254 South Fourth Street, Columbus, O., $375; Van Dorn Iron Works, Cleveland, O., $299.50; McCarthy & Corbett, Washington, D. C., $375; Champion Iron Fence Company, Kenton, O., $160.36.

TOMPKINSVILLE, S. I.—The following bids for buoys, chains, and ballast-balls were received by Commodore A. E. R. Benham, U. S. N., April 14:

BIDDERS.	Can Buoys. 2d Class. 16	Can Buoys. 3d 20	Nun Buoys. 1st 5	Nun Buoys. 2d 20	Nun Buoys. 3d 6	Ice Buoys. 1st 15	Ice Buoys. 2d 15	Ice Buoys. 3d 20	Chain, per lb. 1½" 300 fms.	Chain, per lb. 1¼" 1,000 fms.	Chain, per lb. 1⅛" 200 fms.	Chain, per lb. 1" 500 fms.	Ballast Balls. 1st Class. 29	Ballast Balls. 2d Class. (Cans.) 46	Ballast Balls. 2d Class. (Nuns.) 32	Ballast Balls. 3d Class. 20
Hilles & Jones, Wilmington, Del.	$1,362	$978.00	$1,198	$1,948.00	$272.00	$4,485.00	$3,270.00	$3,442.00	....	....	....	....	$742.00	$440.00	$176.00	$82.00
P. Delany, Newburg, N. Y.	1,568	920.00	980	1,600.00	360.00	4,500.00	3,405.00	3,529.00	....	....	....	....	696.00	414.00	160.00	60.00
Isaac Pott & Co., Lebanon, Pa.	1,572	998.20	1,018	1,699.80	269.66	4,121.31	2,716.80	3,212.40	....	....	....	....	625.65	344.43	130.86	95.00
Manning, Maxwell & Moore, New York City	....	....	....	....	....	....	....	....	3c.	3c.	3.15c.	3.28c.	*602.38	*331.20	*109.44	*34.56
Standard Chain and Anchor Works, Philadelphia, Pa.	....	....	....	....	....	....	....	....	3.40	3.40	3.50	3.63	....	....	....	....
West Lebanon Rolling Mill Co., Lebanon, Pa.	....	....	....	....	....	....	....	....	3.14	3.14	3.29	3.35	....	....	....	....
J. B. Carr & Co., Troy, N. Y.	....	....	....	....	....	....	....	....	3.20	3.20	3.30	3.40	....	....	....	....

*Calculated.

JEFFERSON CITY, MO.—Synopsis of bids for marble mantels and floor-tiles in basement and first floor of Court-House, opened April 18, 1887, by Supervising Architect of the Treasury Department: American Marble Company, Marietta, Geo., $1,625; Peoria Steam and Marble Works, Peoria, Ill. $1,693; Pickle Marble and Granite Company, St. Louis, Mo., $1,766.93; Burlington Manufacturing Company, Chicago, Ill., $1,888.12; Davison & Son, Chicago, Ill., $1,834.

ROCK ISLAND, ILL.—Abstract of bids received and opened by Major A. Mackenzie, Corps of Engineers, U. S. A., on April 15, at 2 P. M., for furnishing hydraulic cement for use in construction of dry dock at Des Moines Rapids Canal:

BIDDERS.	Cement, natural, 1,000 bbls., per bbl. of 300 lbs. In bbls.	Cement, natural, 1,000 bbls., per bbl. of 300 lbs. In bags.	Cement, Portland, 20 bbls. Per bbl
James NcNamara, Keokuk, Iowa	$1.45*	$1.25*	$3.75
Meacham & Wright,** Chicago, Ill	1.33†	1.03†	....

*Louisville or Milwaukee. †Utica.
**Delivery in bags accepted. Written contract made.

WASHINGTON, D. C.—The contract for 33 skylights in the new Pension Building was recently awarded to George Hayes & Son, of New York. This firm declining to execute the contract, the contract has now been given to Morgan, Thomas & Co., of Washington the next lowest bidder, at $1,697.50.

GALVESTON, TEX.—Abstract of proposals for constructing a jetty at entrance to Galveston Harbor, Tex., received in response to advertisement dated March 10, 1887, and opened April 16, 1887, by Major O. H. Ernst, Corps of Engineers, U. S. Army:

BIDDERS.	41,500 cubic yards Ordinary Rip-rap. Per cubic yard.	36,600 cu. yds. blocks of stone, weighing from one to two tons. Per cubic yard.	16,300 cubic yards Clay. Per cubic yard.	Total.
John Satterlee, Engelwood, N. J.	$4.28	$5.88	$3.98	$457,702
Charles Clarke, Galveston, Tex.	5.04	6.24	2.08	471,863
Rittenhouse Moore, Mobile, Ala.	4.54	7.70	1.50	494,680
A. M. Sherman & Co., Galveston, Tex.	2.60	4.40	1.70	296,650
Gustav Wilke and John W. Rickey, Austin, Tex.	2.90	4.73	1.20	313,028
La. Jetty and Lightering Co., New Orleans	2.85	4.80	1.55	319,220
T. J. League, Galveston, Tex	3.58	5.86	1.75	391,571

NEW YORK.—Bids were opened at the Army Building by Henry C. Hodges, Deputy Quartermaster-General, on April 16, for the erection at Willet's Point, New York Harbor, of a double set of officers' quarters, with cistern, plumbing, tank, etc., for each set, and for a 24-bed hospital and a dead house, with the plumbing, etc., complete.

The following were the bidders: James L. Young, quarters, $25,566; hospital, $18,530; J. H. O'Rourke, for both, $31,900; Richard Cahon, hospital, $14,860; Charles B. Bell, hospital, $18,540. No bids were received for constructing the dead house.

WASHINGTON, D. C.—The following proposals for water-meters, to be delivered F.O.B. in Washington, were opened by the District Commissioners on the 16th inst.

BIDDERS	Five 4-inch. Iron Body.	Fifteen 3-inch. Iron Body.	Thirty 2-inch. Bronze Body.	Thirty 1½-inch. Bronze Body.	Fifty 1-inch. Bronze body.	Fifty ¾-inch. Bronze body.	Ten ⅝-inch. Bronze body.
Union Water-Meter Company Worcester, Mass.	$200.00	$100.00	$60.00	$40.00	$25.00	$18.00	$12.00
Thornton N. Motley, agent, Thomson Meter, New York City	264.00	132.00	66.00	48.60	26.40	20.00	12.00
E. C. Terry, Hartford Conn.	190.00	95.00	60.00	42.00	26.00	18.00	12.00
Henry R. Worthington, New York City	245.00	79.00	36.00	32.00	25.00	17.75	11.25
"Empire"	213.50	....	47.25	....	25.75	19.37	13.00
"Gem," (including connections)	198.00	99.00	49.50	....	....	....	....
"Crown,"	302.00	151.50	76.00	....	30.50	22.75	13.75

ABSTRACT of proposals for dredging in East Chester Creek, N. Y., received in response to advertisement dated March 22, 1887, and opened April 21, 1887, by Lieutenant-Colonel D. C. Houston, Corps of Engineers, U. S. A. The Hartford Dredging Company, Hartford, Conn., per cubic yard, 47 cents; total, $14,100. A. J. Beardsley & Son, Bridgeport, Conn., per cubic yard, 49½ cents; total, $14,850. The Frank Pidgeon Dredge Company, New York City, per cubic yard, 26.9 cents; total, $8,070.

PROPOSALS.

TOO LATE FOR CLASSIFICATION.

REPAIRS to Outer Day Beacon, Bridgeport Harbor, Conn. Until April 30 Address Lieutenant John Millis, U. S. A., Engineer of the Light-House District, Tompkinsville, N. Y.

FURNISHING and placing rip-rap stone at Tarrytown, N. Y. Until April 30. Address Lieutenant John Millis, U. S. A., Tompkinsville, N. Y.

FURNISHING 6-inch cast iron water-pipe. Until April 30. Address Lieutenant John Millis, U. S. A., Tompkinsville, N. Y.

Building Intelligence.

WE solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b s*, brown stone; *br*, brick; *br st*, brick store; *b s dwell*, brown-stone dwelling; *apart house*, apartment-house· *ten*, tenement; *e*, each *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

AMONG THE ARCHITECTS.

We report the following from the offices of New York architects:

New York.—Hay, grain, and feed warehouse, s s 34th St., e of 12th Av.; brick and stone; dimensions 120x97; cost $35,000; for Mr. Horace Ingersoll; architect S. B. Pelham.

Cleveland, O.—Architect J. R. Thomas is preparing plans for a stone church to cost $150,000; dimensions 90x155.

Ridgefield, Conn.—Dr. Bache McEvers Emmet, of New York, has engaged architect Clarence S. Luce to prepare plans for a stone and frame dwelling to cost about $12,000; dimensions 140x46.

New York City—Architect R. Napier Anderson has prepared plans for two stone dwellings to be erected on Fifth Avenue, between Seventy-seventh and Seventy-eighth Streets. The building will be five stories high and will contain elevators and be heated by steam. Each will contain a conservatory. The houses are for a New York gentleman and will cost $85,000 each.

Southport, Conn.—Mr. E. B. Monroe, of this place, will erect a library building over 100 feet in length, of Long Meadow brownstone. The cost will be about $50,000. Architect Richardson is preparing the plans.

Newport, R. I.—J. D. Johnston, architect, has the following buildings under way: Residence for Miss Lena Briggs, at Taunton, cost, $7,500; residence for Mrs. A. A. Chase, of Springfield, cost, $12,000; Smith Memorial Hall, at Dighton, Mass., cost, $15,000; rectory for St. Joseph's Parish, Newport, cost, $7,400, besides several small jobs less than $7,000 in value.

NEW YORK.

68th st, s s, 145 w 3d av, 3-story st and br dwell; cost, $20,000; o, Isaac Stern, 835 Madison av; a, Wm Schickel & Co; m, Thomas Dobbin; c, John Downey.

70th st, s s, 181 e 2d av, 2 5-story br tens; cost, $18,000; o, William McNabb, 1351 Lexington av; a, J C Burne; c, day's work.

82d st, n s, 106 e 1st av, 7 5-story br and st tens; cost, each $12,500; o, Frederick Schuck, n w cor Av A and 85th st; a, John Brandt.

85th st, s s, 6 5-story br and st tens; cost, each $12,500; o, Frederick Schuck; n w cor Av A and 85th st; a, John Brandt.

120th st, n s, 150 w 4th av, 9 4-story brick dwells; cost, each $12,000; o and a, David T Davies, 120 E 112th st; b, day's work.

1st av, e s, 30 n 70th st, 5-story ten; cost, $18,000; o, J L Buttenwiser, 305 E 57th st; a, G B Pelham; b, John Van Dolsen.

4th av, s w cor 122d st, 4 5-story br tens and stores; cost, corner $18,000, others $12,000 each; o, Jacob Wicks, Jr, 67 E 92d st; a, John Brandt.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by Henry C. Meyer, in the Office of the Librarian of Congress at Washington, D. C.

Volume 15. Number 22. } Published every Saturday.

NEW YORK, APRIL 30, 1887.

LONDON, MAY 14, 1887.

Single Copies, Ten Cents. Subscription, $4.00 per year in advance, post paid. } In America

Single Copies, Sixpence. Subscription, 20s. per annum in advance, post paid. } In Great Britain.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* Henry C. Meyer, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 Fleet St., London.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of The Sanitary Engineer and Construction Record (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A. Brockhaus, Esq., Querstrasse 29, Leipzic, Germany, and Asher & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to The Sanitary Engineer and Construction Record.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

THE ADVANTAGES OF SPECIAL TRAINING.

The New York *Sun* of April 24 prints a two-column editorial on "The Science and Art of Railroading," in which the value of a technical education for managers of railways and large corporations is very ably set forth. It calls attention to the schools established by the Baltimore and Ohio Railroad Company and the Pennsylvania Railroad Company at Altoona. It illustrates the utility of such institutions by the example of the Pennsylvania Railroad Company, which controls by all odds the best railroad of the world, and by common consent the best-managed railroad of the United States, which excellence, it says, is "not due to chance or to exceptional local advantages, but to the fact that for many years it had for its president Mr. J. Edgar Thompson, 'a civil engineer of excellent education and judgment,' who was succeeded by Thomas A. Scott, a man of 'remarkable genius but no technical education,' who once remarked that he might make a mistake costing the company three millions and nobody find it out. He was succeeded by George W. Roberts, a civil engineer, educated at Troy Polytechnic, who is by far the best president the road has ever had, inasmuch as he carried scientific wisdom into every branch of its affairs; Mr. Cassatt, Mr. Frank Thompson, Mr. Pugh, Mr. Provost, and Mr. Ely, and all or nearly all the Division Superintendents being educated as civil or mechanical engineers. These gentlemen are perfect masters of all the details of their duties, nothing being done on that road by 'rule of thumb' or without a scientific reason."

The article also refers to Mr. John King, Mr. Samuel M. Felton, Jr., and Mr. R. H. Soule in the management of the Erie Railroad as gentlemen specially educated for their profession. It then says: "Here our commendation of the management of railroads having their head offices in New York must cease. The New York Central and New Haven and Hartford are conspicuous examples of rule-of-thumb management, their making dividends being solely due to the exceptional advantages of their position rather than to good management. Since, however, Mr. Depew has come to the head of the New York Central Railroad, great strides have been made towards putting the road into first-class condition under scientific management. Mr. Walter Katte being now in charge of its permanent way and buildings, great improvements and economies have been realized."

The *Sun* further says that it should not neglect to mention the "improvement in the management on some of the New York Central's controlled lines, Mr. Newell, of the Lake Shore, Mr. Caldwell, of the New York, Chicago and St. Louis, and Mr. Ledyard, of the Michigan Central, all being able and experienced managers, technically educated." Referring to Mr. Ledyard, who was a graduate of West Point, it says: "We once heard of a 'Boston banker' who, before he went down to Boston, was profoundly unhappy unless he had pie at breakfast and supper, condemn a railroad because it had 'too much West Point and Pennsylvania Railroad' in its management." Regarding the management of the New York, New Haven and Hartford, the *Sun* is not so complimentary, describing Mr. Charles P. Clarke, its president, as being educated at a country college, selling rum and molasses on the coast of Africa, and entering the railroad business as a clerk to the receiver of the Boston, Hartford and Erie Railroad. Mr. Clarke is credited with having dismissed a competent engineer of permanent way with the contemptuous remark "that he did not want any road-master in his service who was not brought up with a pick and shovel." "The condition of this railroad and its controlled lines, with its splendid traffic and princely income, is proof positive that it now needs men with technical education in all departments. If any reader doubts this let him examine one of its cast-iron bridges, or even the stone bridge this side of Stamford, which is prevented from falling down by a framing of wooden beams and iron tie-rods, all held in place by half-inch spikes driven into the stone-work under each beam."

After mentioning many railroads and officers prominent in their management, the *Sun* especially commends the Boston and Albany Railroad as an exception to the unpardonable practice of employing men not specially trained in its service, and as being, under the presidency of Mr. William Bliss, one of the best and most scientifically managed railroads in the country. We regret that want of space forbids our quoting this article entire, since the same arguments might with so much truth be applied to the management of all municipal undertakings.

IMPROVEMENT IN CHURCH ARCHITECTURE.

In an article on "The Church of the Future," the editor of the *Building News* calls attention to the fact that while the lecture-room, the concert-hall, the theatre, and almost every form of assembly hall is now planned with reference to its uses, so as to enable men to hear and see to the best advantage, the church alone remains unchanged, and the models of the thirteenth century are still adopted as those of the nineteenth. "The architect who would venture to place the centre line of his church north and south instead of east and west would be a bold man indeed; while no church with any pretensions to style and appearance, however much it may be hemmed in with lofty buildings, is thought to be complete without its heaven-directed spire, the very purport of which has become obsolete."

"The student of acoustics would inform us that the interior of any building which is to contain a large audience must approximate somewhat to the shape of an egg, the small end being depressed, so as to throw the central line into an oblique direction, slanting upward from the focus. In the focus of the smaller extremity would be the best position for the speaker, and in a structure having this form every person present should have an equal chance of hearing. Bearing this fact in view, we can readily judge the vast disparity between the theory and the practice in the construction of churches, regarded merely as places to hear in. Moreover, the speaker who understands the management of his voice knows that in order to make the sound travel he must elevate his chin and expel the words upward and outward. In this way he can inflate his chest, use his throat to advantage, and speak with the least exertion. The conditions under which the clergyman is called upon to preach in nine churches out of ten preclude him entirely from this natural and obvious use of his vocal organs. He has to turn his face downward in order to address a congregation at his feet, or placed on a level much below him, causing him to strain his throat and injure his voice. Until he becomes used to it, there is a sense of discomfort and annoyance in having nobody

before him and above him to speak at, and hence the weak throats and strained voices of so many clergymen amongst our acquaintances. The remedy for this is simple enough, though it is one the church-planner will avail himself of with the utmost reluctance: the floor of the church must rise from the chancel to the west end, so that the congregation may incline upward from the pulpit, which latter should be lowered.

In churches where large numbers have to be seated, galleries at the sides and ends may be introduced with advantage, and the internal piers and columns must be sacrificed. The vast internal height of many of our churches is another great defect; not only is sound swallowed up and lost, and much distressing reverberation awakened among the open timbers of the roof, but difficulties in the matter of heating and ventilation are also caused, which few church-goers can have failed to perceive. Indeed, medical men we have spoken to have assured us that more illness is ascribed to draughty and badly-warmed churches than to any other source, while comfort in respect to warmth and fresh air is certainly conspicuous by its absence."

While these remarks are not applicable to a large number of American churches, they do certainly hit a goodly number of them which are planned much more with reference to ornament than to comfort or utility.

THE twelfth annual report of the Board of Commissioners of Parks of the city of Boston gives a very complete financial exhibit, showing the total expenditures for construction and maintenance in the eleven years of the board's existence to have been $4,041,687.71. There is a report by Frederick Law Olmstead on improvement of the grounds reclaimed by the Charles River embankment; map and description of the proposed Marine Park, with special illustrations of the temporary pier now in use; a brief report by Professor C. S. Sargent as to the condition and progress of the Arnold Arboretum; a map of the proposed Jamaica Park, and a report by the City Engineer, Mr. William Jackson, on work accomplished at the several parks during the year.

The commissioners are Messrs. Benjamin Dean, Patrick Maguire, and John F. Andrews.

OUR BRITISH CORRESPONDENCE.

Vienna as a field for Electric-Lighting—Disposal of London Sewage—Gas-Lighting in Omnibuses.

LONDON, April 13, 1887.

THE British Consul in Vienna is of the opinion that that city is a very promising field for some enterprising electric-light company with plenty of capital. The present companies have done little business for want of sufficient capital. He further says that in large industrial establishments which use the electric-light the price per hour for arc-lights varies from 1.2*d.* to 3.6*d.*, and for incandescent lamps from 0.12*d.* to 0.48*d.*, according as gas, steam, or water is used as a motor.

Mr. Bailey Denton has just read a paper at the Parkes Museum on the question of the "Disposal of Metropolitan Sewage." The lecturer commented severely upon the action of the Metropolitan Board of Works in wholly disregarding the utilization of the metropolitan sewage, and in their determination to construct underground tanks at the Barking outfall, in a district where the population is increasing at a greater ratio than in any other metropolitan suburb, and where the extension of building will shortly crowd out all possibility of utilizing the collected sewage without local nuisance. In Mr. Bailey Denton's estimate of the value of human excreta, he said he adopted the view of Mr. Chalmers Morton, one of the River Commissioners, who puts it at the same value as that accorded to sheep's excreta by farmers—*i. e.*, 5*s.* ($1.20) per head per annum. Applying this to the 4,000,000 population, it represented £1,000,000 ($480,000,000) per annum loss to the country by throwing the sewage of the metropolis into the sea. He upheld the system of intermittent filtration, safeguarded by wide irrigation, as the most profitable mode of utilizing sewage, pointing out, however, that the process of intermittent filtration was constantly abused and brought into disrepute by the action of the servants of local boards. The land laid out for intermittent filtration was not treated fairly, but being constantly and continuously flooded beyond its capacity, was turned into an offensive swamp. He regretted the conduct of the Metropolitan Board, in resorting to homœopathic doses of 3.7 grains of lime.

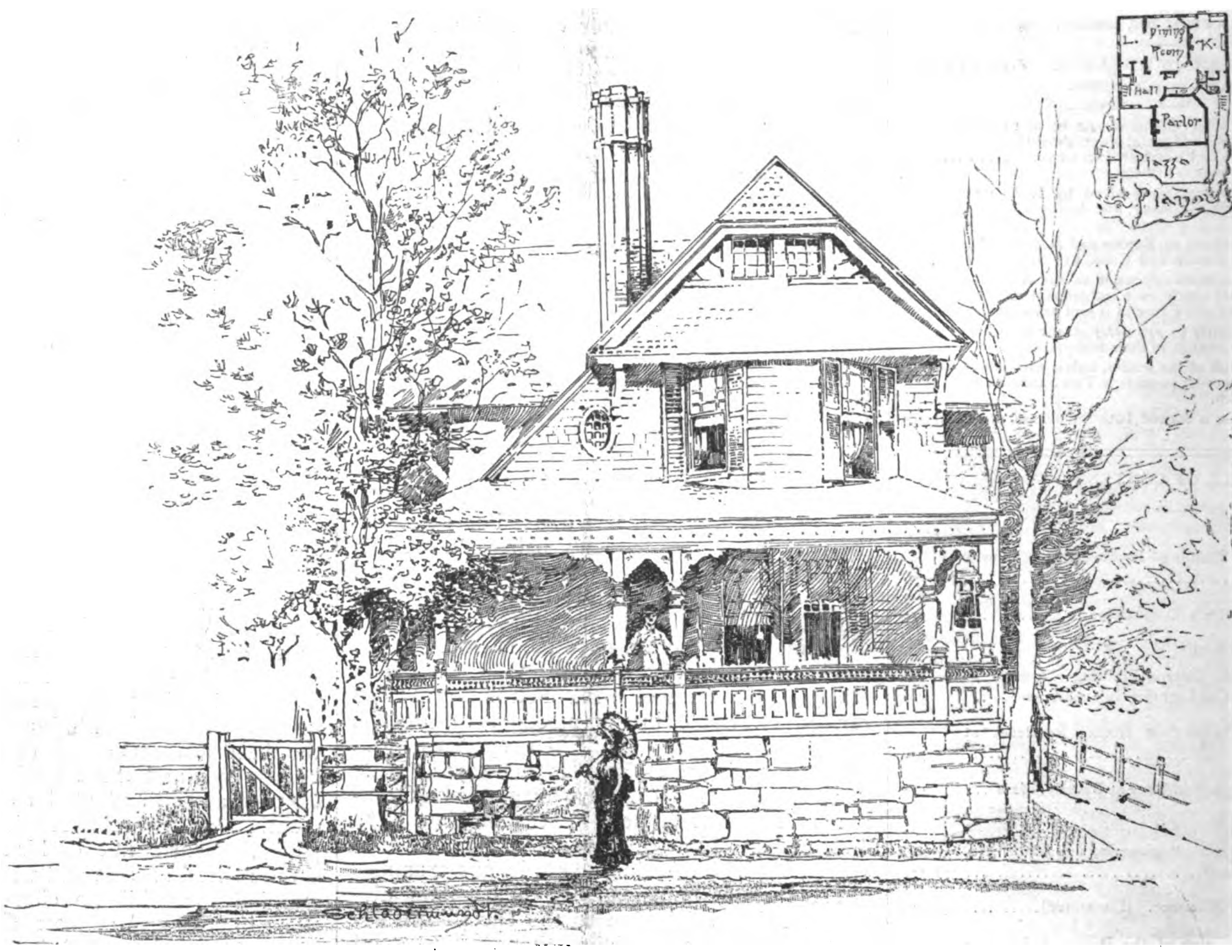
The system of lighting by gas has been applied to the omnibuses on one of the routes between two stations. The vehicles in question are large and for three horses. The storage is equal to about three evenings' consumption, for about five hours each night.

SAFETY VALVE.

OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

RESIDENCE AT YONKERS, N. Y.—HENRY RUTGERS MARSHALL, ARCHITECT, NEW YORK.

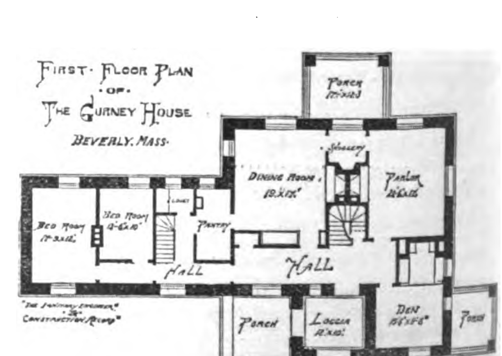
OUR vignette illustration shows a residence owned by Mr. F. S. Bangs, located at Yonkers, N. Y. The material used in the construction of the first story is iron and the other stories are of wood. The finishings are rubble, cut joints, clapboards in the second story, shingles on the roof and gable. Mr. Henry Rutgers Marshall, of New York, is the architect.

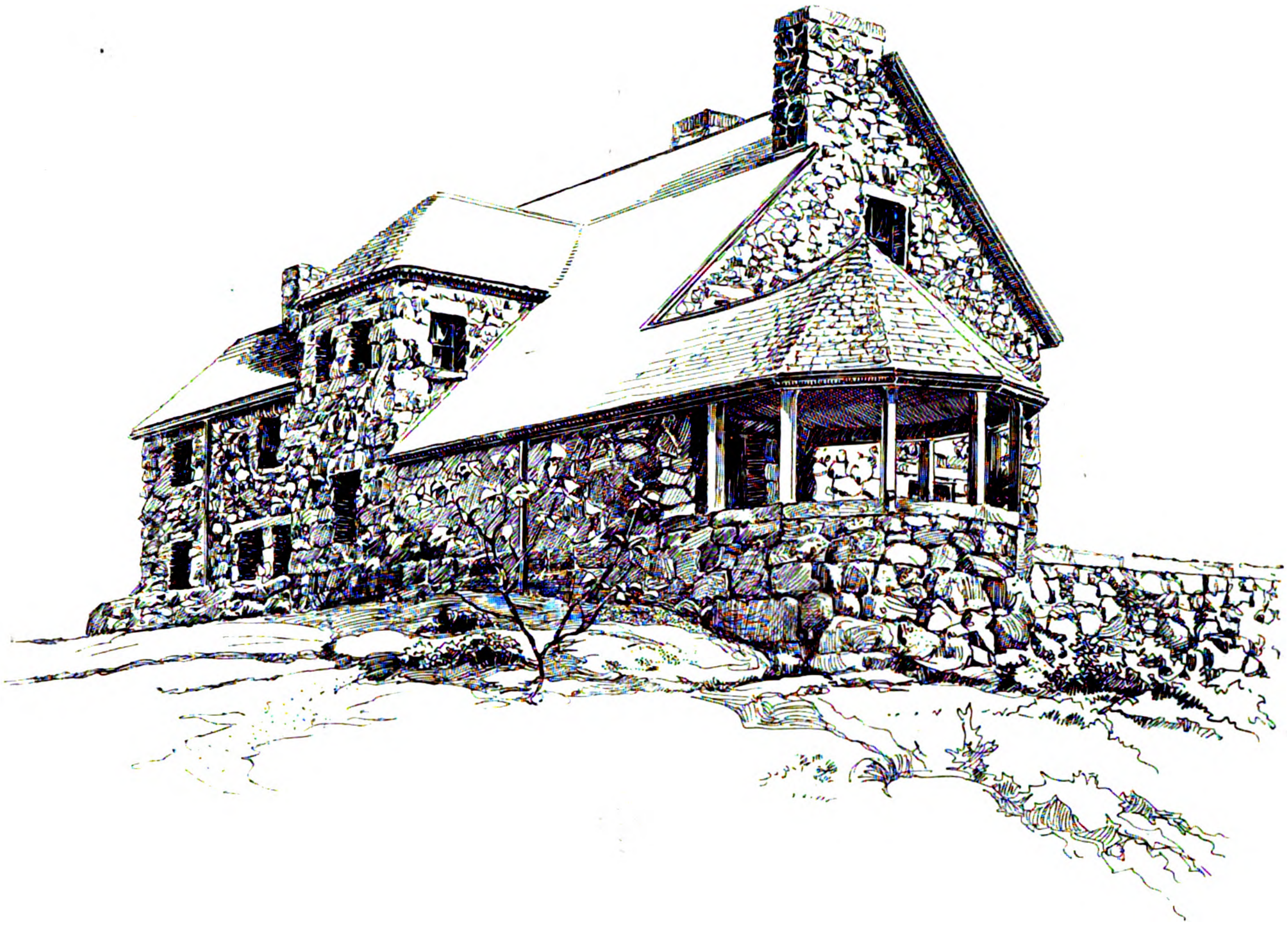


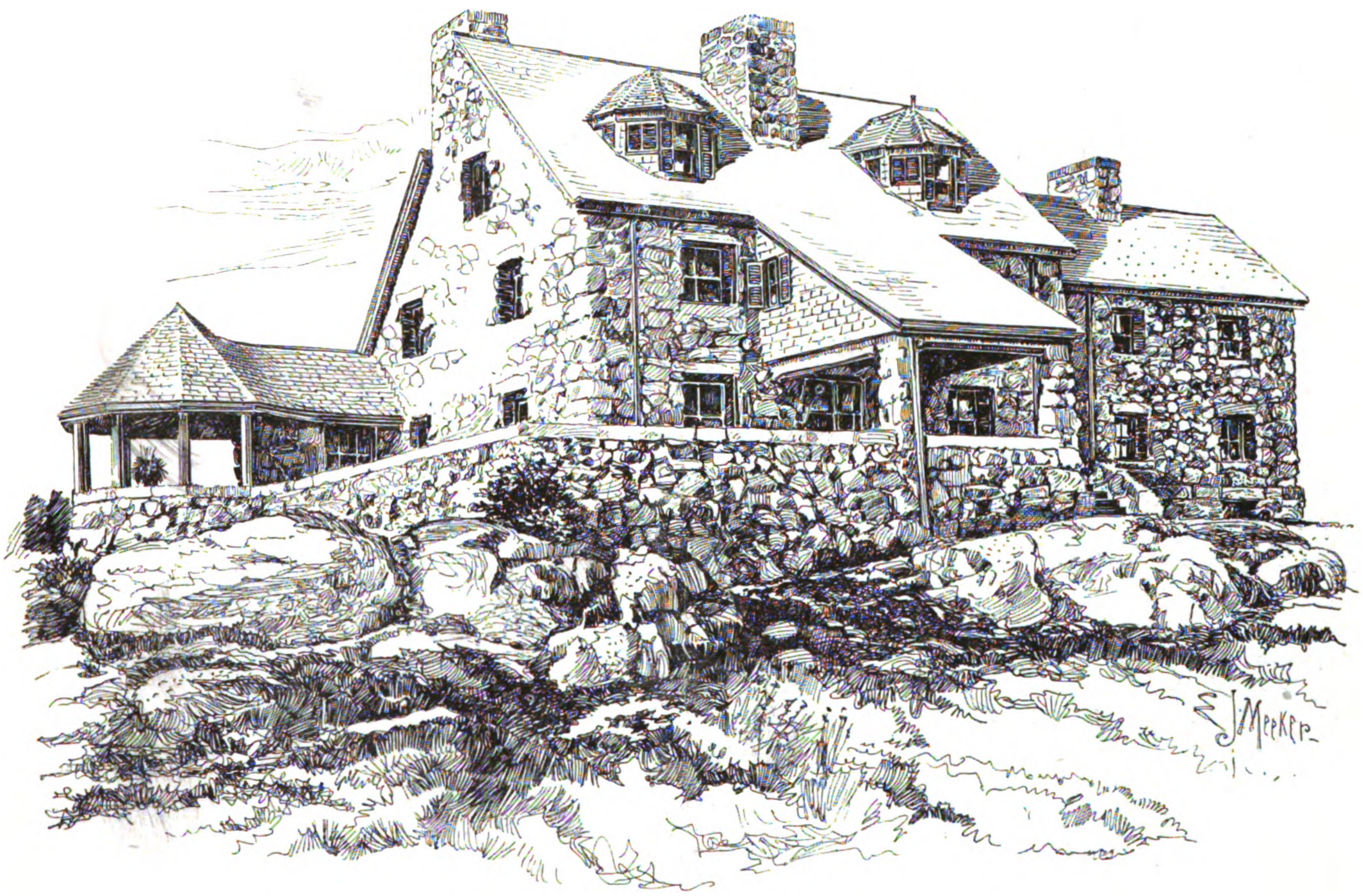
A RESIDENCE AT YONKERS, N. Y.—HENRY RUTGERS MARSHALL, ARCHITECT.

OUR SPECIAL ILLUSTRATION.

THE subject of our special illustration is the residence of Mrs. E. W. Gurney, at Beverly, Mass. It was built of field stones picked up on the place. Its cost was $18,173. The architect was the late H. H. Richardson.







THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCE OF MRS. E. W. GURNEY, BEVERLY, MASS.

H. H. RICHARDSON, ARCHITECT.

ENGINEERING & ARCHITECTURE

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XVII.

(Continued from page 484.)

THE illustrations Figs. 62 and 63 give full working details of a traveler now in use in the erection of the iron-work of the Suburban Rapid Transit Railway in the "annexed district" of New York, of which work Mr. J. J. R. Croes is engineer in chief, and Mr. Fred S. Odell is assistant engineer in charge. The machine is supported on four double-flanged wheels 20-inch diameter and 14-inch tread, which travel on the upper flange of the outer girders of the finished work.

At four points located as shown by the black spots in the half plan (Fig. 62) a pair of clamps (see Fig. 63) suspended to eye-bolts are dropped down so as to hook under the edges of the upper flanges of the girders and screwed up tight by the nuts, as shown, thus anchoring the whole frame rigidly to the iron-work. The working platform is 34 feet long over all and 23 feet wide, and its framing consists of 6x12-inch sticks, except two 12x12-inch at the derrick end, and an 8x12-inch at the rear. There are vertical triangular frames each side, consisting of a 12x12-inch vertical post, an 8x10-inch inclined strut to resist backward thrust, and a 1¼-inch backstay to take the pull from loads on the side derricks. These frames are joined at the top by a 12x12-inch cross-timber mortised on and attached by side bolts, as shown. This cross-timber is stiffened the whole length on top by a 12-inch iron channel with flanges turned down.

This channel also serves for attaching the plates for the backstay-rods at the centre and ends, and supports for the upper pins of the derricks. The two backstays for the central derrick are each 1¾-inch diameter. There are also four 1-inch cross-stay rods, as seen in Fig. 63.

The masts are 24 feet high, supported on a spherical-shaped projection on the foot-plate fitting a corresponding depression in the cast socket at foot of mast.

The main boom (for the central derrick) is 54 feet long over all, and is composed of two 6x12-inch sticks placed flatwise in the vertical plane and swelled out by distance-pieces so as to be 20 inches wide horizontally at the centre. Taper-pieces are then bolted on at the top and bottom, as shown. There is also a strong box-like arrangement of iron at the outer end, of which details are given in Fig. 63, and plate-iron cheek-pieces at lower end.

The two side booms are shorter, and are simply plain sticks, with bands, etc. The pins in the masts are 2½-inch diameter, secured by a through-pin below and a cotter above.

The hoisting ropes are led to sheaves below the masts, then centrally through the masts to the sheaves in the same as shown above the booms, and thence to the sheaves in the booms near their ends.

The thrust at the foot of the central derrick is taken up and distributed through the platform by 4x12-inch braces.

The derrick, as a whole, is well worked out, but it is desirable to point out certain elements of weakness which can be easily remedied.

First—The platform is not as stiff longitudinally against vertical deflection as is desirable, as was evidenced by the amount of sag which it had.

Second—The direction of the central boom when in use being at times but little above the horizontal, there was a positive tendency for the foot of the mast to shove up on the spherical boss of the foot-plate and unseat itself.

Third—It will be seen that the short timbers on which the foot-plates of the derrick rest will have a tendency under the action of the thrust from the boom to rotate longitudinally in a vertical plane. This could be readily remedied by carrying them farther back, so as to cross one or more additional cross timbers.

These defects made it necessary to round the rear portion of the derrick-masts and place abutting blocks against which they bear while rotating.

Figure 64 shows the hoisting-engine used in connection with these derricks, and is especially adapted to this class

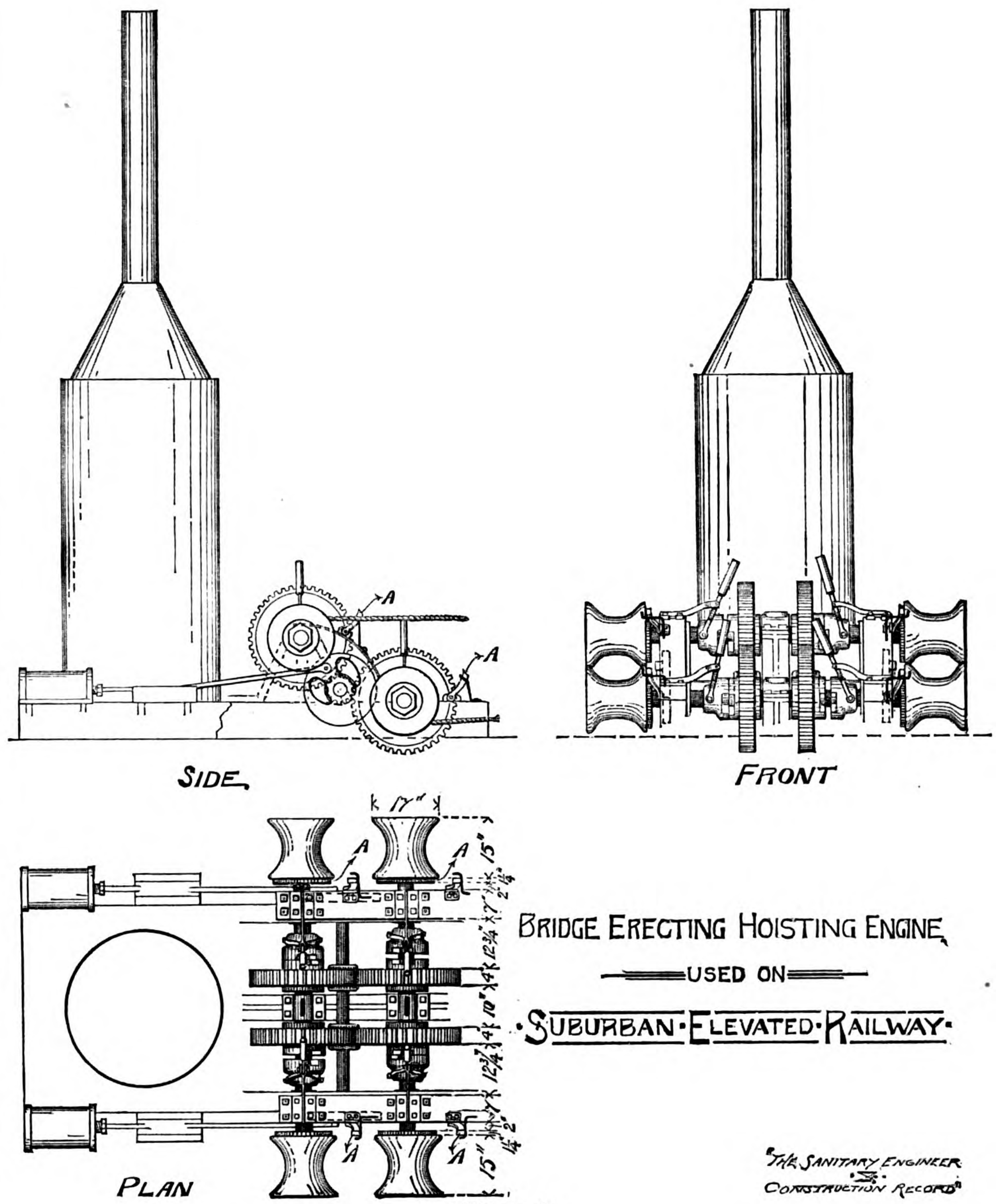


FIGURE 64.

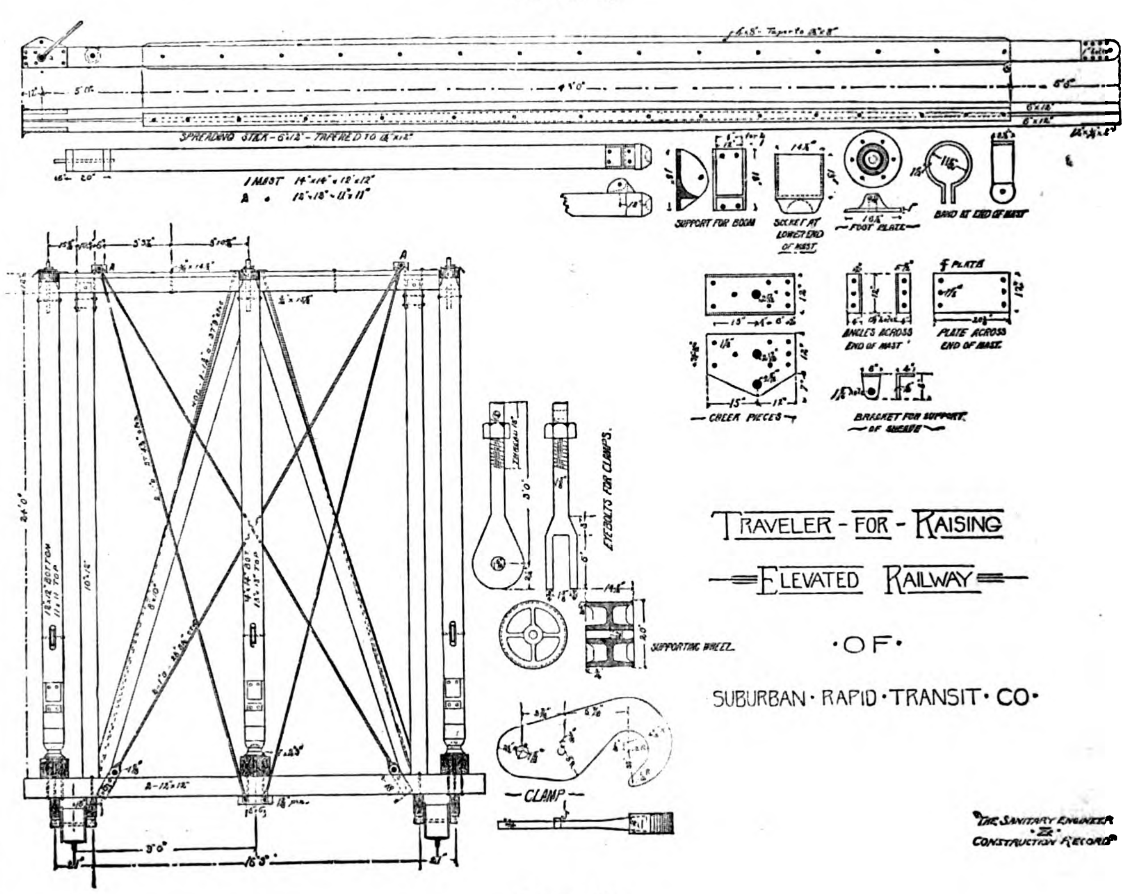


FIGURE 63.

of work. The general design was worked out by Messrs. Baird Brothers, so widely and favorably known as bridge erectors. The mechanical details and the construction of the machine by the manufacturer, Mr. J. S. Mundy, of Newark, N. J.

Since this machine was made, they have made a number of 6-spool machines for use on various important works, such as the Henderson, Omaha, and Havre de Grasse bridges, etc.

It will be seen that the motion is transmitted through a spindle with pinion, to two spur-wheels which are continuously in motion, and having a common direction. These turn loosely on the shafts which bear the spools or capstan-heads. The shafts are four in number, of steel, and 3¼ inches in diameter, and each carry one spool, and a clutch sliding on a feather. There are separate levers to each clutch, so that any one or all can be operated as desired. Each spool has a ratchet attached, and a pawl is provided so that the clutch can be thrown out and the load still held. If the load be too heavy for one spool to hold it readily, one or more turns can be taken around the second spool on the same side by the man attending the fall. The steam cylinders are 7x12 inches, and the gears are 1 to 5.

The facilities furnished by this system as a whole are obvious.

The central derrick sets the posts in advance, and places the cross-girder between them, and the two side derricks can be used simultaneously for placing the longitudinal girders, of which there are four.

(To be continued.)

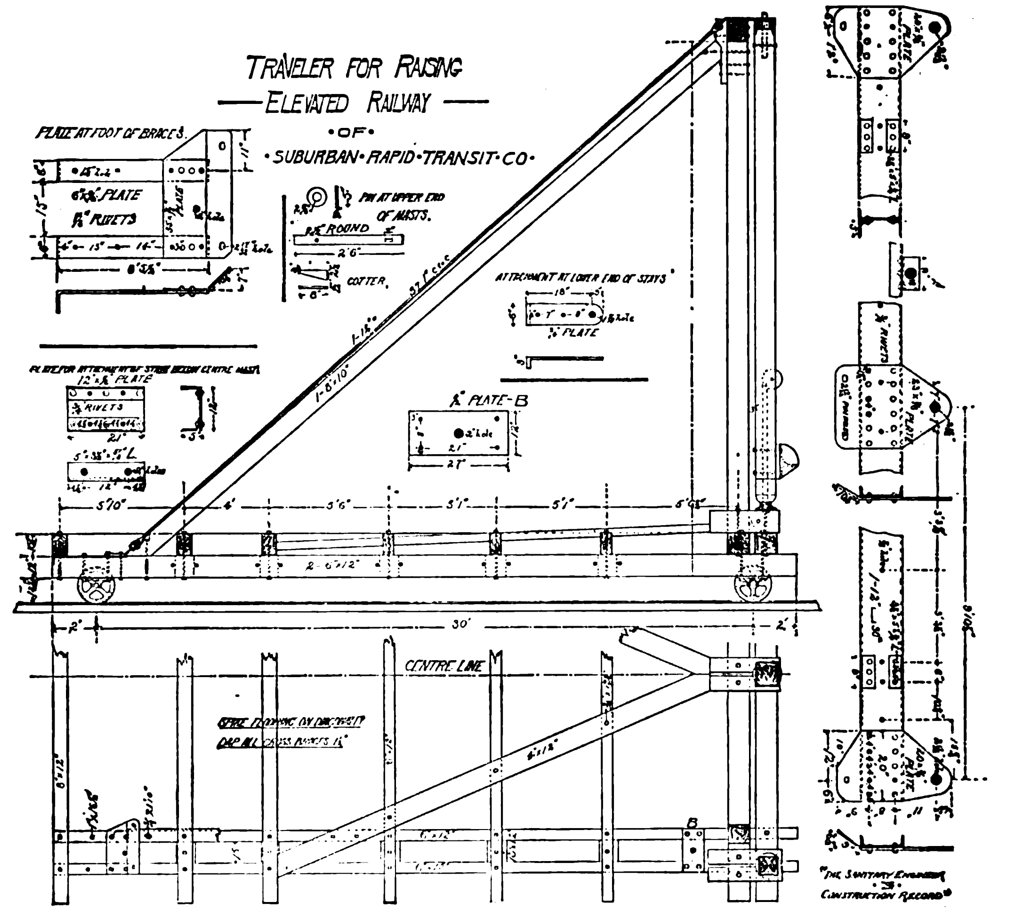


Figure 62

THE MILWAUKEE RIVER NUISANCE.

The Milwaukee *Sentinel* some time since published the following lucid explanation of a plan for solving one of its municipal sanitary engineering problems. "Professor Pottie" will, doubtless, take high rank among "newspaper experts."

SOLVED AT LAST.

How the Great Milwaukee River Nuisance may be Abated —The Unofficial Report of Professor Archimedes P. Pottie—The Advantage of Employing an Inexperienced Engineer—A Grand Scheme to Make the People's Money Fly.

It has been the pleasure of the writer to be a resident of this city during the past year, and the more he has learned of your ways the more he is impressed with the wisdom and energy of your public officials in their dealings with questions of public moment brought to their august attention; and it is with great grief that I find your columns open to articles of a somewhat scurrilous nature, in reference to some of the acts of your Common Council—composed of men selected from among our most intelligent citizens, and who, without hope of reward, except in an occasional horse trade, give their time and ability to its welfare. Hence it is a matter of surprise that your columns have not been crowded with articles controverting the haphazard and unscientific statements of some of your correspondents. I allude more particularly to those communications on the action of the council in reference to the proposed flushing of our beautiful Milwaukee River.

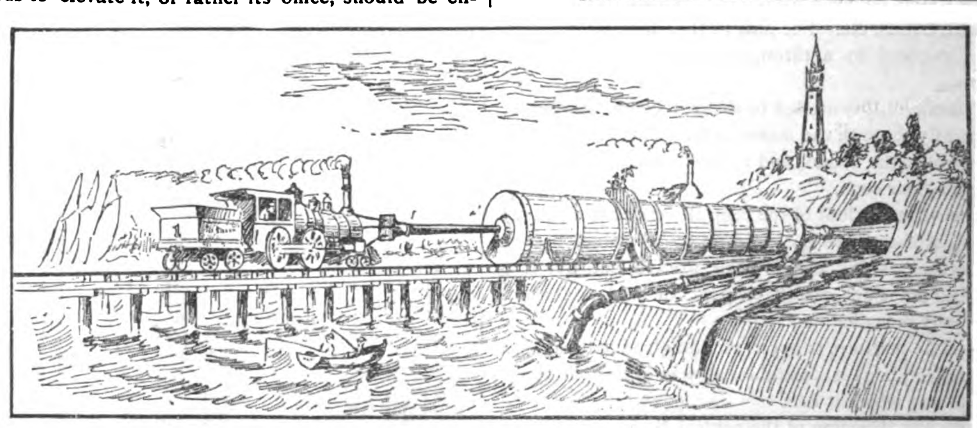
It seems to me that with the advent of cold weather, when the council can with safety take the clothes-pin off the nose of the Goddess of Liberty that surmounts the council hall, this subject can be properly handled and considered by a master mind; that facts and conclusions may be presented free from exhibitions of temper and with the same impartiality a physician would exercise in making a post-mortem examination of his mother-in-law.

That this communication may receive the attention it deserves, I ought to say that I am by profession what may be termed an Hydrodrynamic Engineer, having had some little experience and considerable notoriety in dealing with hydraulics generally and particularly with dirty water.

The Hon. John W. Cary takes it for granted that our river-water obeys the laws of hydraulics and hydrostatics as established by D'Aubisson, Beardmore, and our own Francis. But the Common Council, in its superior wisdom, correctly assumes that the semi-fluid river is amenable to no known law, or that all laws in relation to water are paralyzed when brought into contact with this remarkable river, or that all established law is reversed in this case. As an expert, I was selected by the Olfactory Committee of the Council to discover some plan to ameliorate the condition of the river. My first requirement was that the council should get command of $175,000 as a starter, being only one dollar for each man, woman, child, and dog in the city. This was so satisfactory that I was further requested to formulate a plan in detail, how this and such additional amounts as could be secured, might be spent to advantage, and to make a report through some respectable city paper. The committee is to be congratulated on the sagacity shown in my selection. There is a vulgar impression that in selecting expert engineers only those should be employed who have been to some degree successful in their specialty. This is a prejudice that is rapidly passing away. The director of our national astronomical observatory must be a sailor; notwithstanding we have men of eminent scientific attainments in the Engineer Department of the army, the head of the Weather Bureau is selected from the Cavalry Department—probably because of his horse sense. What qualifications do we require of our jurors beyond a fear of the wrath of the Almighty, and that they know nothing further? Only in the selection of an expert, without previous knowledge and experience, can you hope for a successful solution of your difficulties.

In entering upon my investigations it was necessary to make certain hydrographic and odormetric surveys. The usual hydrometric methods were employed. The odormetric surveys were conducted on an original plan and with instruments of unique design. Noseomotry, as a science, is still in its infancy. All persons have not the same personal olfactory equation, and in order to provide some accurate measure of repugnant odor, I was induced to devise an instrument that should, and doubtless will, command the attention of scientists here and elsewhere.

My researches in this direction have also led me to discover an hitherto unknown fact in physiology. It will be admitted that the human proboscis is the least useful and also the least ornamental of our organs, and any discovery that tends to elevate it, or rather its office, should be encouraged. It is a well established fact that those nerves that convey the sensation of touch, sound, and sight extend from the epidermal surface direct to the brain and convey sensation at the rate of ninety feet three inches per second. Hitherto no one has been able to determine where the other end of the olfactory nerves terminated. My investigations demonstrate that they run from the tip of the nose plump to the stomach, there end in a ganglionic bunch, and when unduly excited by fetid odors, communicate energy to the motor nerves and thence to the muscles, producing twitching, gripes, jerks, etc., and under great provocation retchings.



Almost every citizen in Milwaukee has felt the existence of this group of corpuscles under his waistcoat or her corset (as the case may be) when passing Spring Street bridge of a warm summer evening. My machine is intended to record these evidences of nausea, and consists of an ingenious arrangement of bands surrounding the waist of the observer, which, through the muscular movements before mentioned, communicate motion to a delicate needle upon a dial conveniently hung from the suspender-buttons, and the amplitude through which the needle oscillates determines the relative fetidity of the atmosphere at the locality. It is well known that a bad atmosphere blunts the sense of smell; therefore, to render the instrument of service to the average Milwaukeean, I have added an electric attachment and battery, consisting of a quart bottle to be carried in the right-hand breeches pocket, whereby any degree of sensitiveness may be secured to suit each individual case.

I may say that the data collected by this ingenious machine has been of great aid to me in reaching a sure and safe solution to our river difficulty, and had I felt warranted in making the same public by adding a column

to our daily weather report, under the head of "Relative Fetidity," I doubt not that this addition would have made that publication interesting reading matter. This valuable instrument will hereafter be known to the scientific world as the Recording Electro-Stink Meter. Our artist has prepared a spirited engraving of it.

Several members of the council have expressed a desire to be supplied with this instrument for their personal use, and it is believed it would be ornamental and would add grace and dignity to the aldermanic paunch even in a higher degree that the famous aldermanic badge. It is believed, also, that by furnishing our respected municipal magistrate with one of my meters, he can, by taking a smell of the *genus homo* tramp brought before him, determine, by the fluctuations of the needle, his proper punishment, without further testimony.

Now for the plan, the principle of which will appeal particularly to the experience of medical men for support. It is necessary to consider the Milwaukee River as one of the trinity of alimentary canals in our midst. One alimentary canal in a man's midst is often the occasion of infinite trouble, from occlusions and cloggings and sluggishness. The remedial resources are multiple, and it is from the principle of one of these that I have drawn my plan. I would advise the boring of a hole from above the dam to the lake shore, at which place there should be erected one of my patent double back-action hydromatical squirt machines, which must be of gigantic size. This spirited engraving shows the machine in working order:

The piston-rod is drawn through the agency of a locomotive, the weight of which must be at least 100 tons, and this travels backward and forward to the full extent of the piston-rod.

It is not at all singular that those of your citizens who have had protoplastic glimmerings of this plan should, without exception, locate the entrance of the bore into the river at a point below the dam site, while my plan requires it above. Herein, again, is shown the genius and science of the writer. My esteemed antiquarian friend Buck informs me that he first saw what is now called the river when he was comparatively a young man, and it was then but a tiny rivulet. Eighty years after, or some thirty years ago, the late Dr. Lapham gauged the stream during a moderately dry season and found the flow to have increased to the enormous quantity of from one to two thousand cubic feet per minute. When we contemplate the remarkable growth of our surroundings within the last three decades it is but safe to assume that the river has more than doubled its output in that time. This water must be utilized and will form an important factor in the plan presented. We have already secured $50,000 for the construction of a new dam, and expect $50,000 more. Like all great engineers I have no sympathy with what tends merely toward beautifying our surroundings, as it is claimed this dam will do by recovering the majesty, beauty and sylvan retreats along the river up as far as Humboldt. Absolute utility is the only matter for me to consider, and on this ground I say: Build the dam, but not of stone. This dam should be built of unvulcanized rubber, placed upon wheels running on a track extending down the bed of the river to the mouth of the Menomonee. When in place, and it is desirable to flush the river (according to that erudite lexicographer, Hoyle, a "flush" means a clean sweep) by simply unlatching the dam, it will majestically float down stream and, through its elastic quality, completely fill the cross-section from bed to surface, from dock to dock in all their varied dimensions, thereby shoving the filthy and replacing it with clean water as it advances. By suitable turntable arrangements at the mouth of the Menomonee, the dam on reaching that proximity would swing directly across the stream, thereby preventing any clean water from entering the valley. It may be asked, what will be the effect of this method upon the south and west sides of our city? In the language of one, illustrious, I answer: Bless the south and west sides. If the south and west sides wish their problems solved, let them consult the members of the Heathen Science cure process, and, that failing, a suitable retainer can secure the services of the writer. The critic may ask, how will your dam pass the numerous bridges and how will you get it back again? My answer is that there is no obstacle that cannot be overcome by unadulterated science when directed by the master mind in your service.

Incidentally it may be observed by operating the flushing device only on dark nights and in foggy weather the stench that will flow lakeward at such times will, with the use of the fetidometer, one of which should be furnished each lake captain, indicate a safe entrance to our harbor, in which case the Government can safely discard the use of the fog-horn, which lulls us to slumber so often.

As a relief to the mental strain of making this investigation and report, it has been my pleasure to deliver several 11 o'clock A. M. lectures illustrating with chemical experiments on the flow of spiritual liquids at the laboratory of F. Snyder on Broadway, and one of my most diligent students thereat, Mr. Hans McGinnis, of the Common Council, having taken a deep interest in the subject of flushing, I thought it quite proper to lay this report before him, before it is submitted to the public. He approves it and is glad that it contains nothing of an equivocal nature in his reference to his fellow-members. He has, however, suggested one contingency of a startling nature that has not occured to the writer. What would be the effect on the execution of this plan in case of the death of your expert before its final completion? Doubtless long before its final completion many of our unfeeling citizens would most heartily pray for this event to occur. If he lives, he stakes his professional reputation on the entire success of the plan presented, and what greater guarantee should be asked? In case of death, then, after suitable obsequies and period of mourning, get the dam in position, knock out the wheels and make a fixture, turn Milwaukee River through the tunnel, fill up its former bed below, lay out a grand boulevard along its centre, build in it an intercepting-sewer (how I hate those two words), and then sell off the balance of the accretion to adjoining property-holders, which might be done, so I am informed by my reliable friend Barber, at a price largely in excess of the cost of the entire projected work, and have left for sale to some other city not so favorably situated quite a number of bridges that would be no longer needed.

I am aware that there are in this country twenty or more persons who have each a national reputation as hygienic engineer, who have traversed this continent and the continent of Europe to perfect themselves in their chosen profession. You do rightly to pin your faith on your expert: you want nothing to do with these scientific humbugs. It is believed that our eloquent member in the Legislature, and former member of our council—he on whom has descended, by direct heritage, that "shriek" that was given when Kosciusko fell—through his influence with the Legislature, and particularly with his companion and friend, the Governor, if properly backed by our citizens, can secure the passage of a bill which will provide sufficient funds for the commencement of this grand scheme.

This is written, Pro Bono Publico, and, in its publication, you are authorized to alter, change, and ornament it as in your wisdom you think proper, for no one is responsible for it, except possibly

ARCHIMEDES P. POTTIE, Phd.,
Amphibious Engineer, etc.

Specialties—
Gas, Wind, and Water.

THE CAUSE AND PREVENTION OF THE DECAY OF BUILDING-STONE.*

No. VIII.

(Continued from page 550.)

DISCUSSION.

MR. BECKER.—Then there is another sandstone on the Ohio River, above Cincinnati, which is so largely charged with coal-tar that I have frequently seen it drop down in large drops, so as to disfigure the whole face of the stone. For a season or two it actually runs down the face of the stone. Now how would that have to be treated?

Prof. Egleston.—I should not think such a stone as that needed any treatment at all. It is already treated. If such a stone is examined with a microscope, it would be found full of petroleum, and its compounds, which are the most serviceable materials to fill the cavities made by the solution of the binding material.

Mr. Becker.—We have that stone in such large quantities that it constitutes almost the only available material for many railroad purposes in that vicinity. We are using it, with the precaution of seasoning always for several months before we attempt to put it in a building.

Prof. Egleston.—I should think such a stone as that would certainly have to be seasoned. Does that stone decompose?

Mr. Becker.—It decomposes from the surface, but so slightly that it would not be injurious in rough structures, such as railroad bridges.

Prof. Egleston.—It would be impossible to tell how to treat it without making a very careful examination to begin with.

Walter Katte, M. Am. Soc. C. E.—Have you had occasion to note or make mechanical or chemical experiments upon brick, terra-cotta, or beton?

Prof. Egleston.—Beton is artificial stone. Brick is very largely porous, and the stains which come upon bricks at the present time are entirely preventable. These stains are the result of a cheap method of making the lime and cement which are now used. Good brick and terra-cotta need no protection, but coating them would prevent the stains by preventing the percolation of the water.

Mr. Flagg.—Will Professor Egleston explain how it is, that since carbonic acid is united chemically with the lime in limestone, the lime can be attacked and disintegrated by water containing the same acid?

Prof. Egleston.—All carbonates are more or less soluble in an excess of carbonic acid, and they are easily soluble provided the solution is dilute. When very concentrated they do not dissolve so easily. When limestone and dolomite occur together, one or the other of the two is apt to be in larger crystals. In the case of the marble altar tombstone in Trinity churchyard, the dolomite crystals are very large. The calcite is in small amount. The tombstone was originally polished, but all the calcite has been dissolved out, leaving dolomite crystals protruding, and so rough that the slab looks as if it had never been polished. In the case of the stone from the quarries in Lee, Mass., of which the Capitol at Washington is built, the dolomite and limestone are together in crystals of about equal size. The stone in the quarry is filled with crystals of tremolite, which is a silicate of lime and magnesia, which is not attacked. Where the quarry stone is exposed to the weather for a long time, the lime has been entirely dissolved out, leavingt he dolomite as a sand through which the tremolite crystals are scattered entirely detached.

T. H. Johnson, M. Am. Soc. C. E.—During my connection with the building of the Indiana State House we used large quantities of oolitic limestone, some of which was dressed by hand and some by machinery. In both cases it was found that the action of the tool left a thin skin of injured surface, which the first winter's exposure would remove. I found also that the stone-cutters use the word "stunned" to designate this injured surface. All workmen engaged in polishing marble, granite, and other stones susceptible of polish, recognize this effect of the tool, and know a good polish is impossible until the whole depth of the "stunned material" has been rubbed down.

Mr. Flagg.—This skin that comes off, does it apply to the machine-dressed or the hand-dressed, or to both?

Mr. Johnson.—To both. In this connection I would also state that I made a series of tests upon the transverse strength and modulus of elasticity of various building stones. Among the samples tested were a large number of oolitic limestones, some of which had been dressed by hand and some had been sawed. I found in all cases that both the strength and elasticity had been impaired by the tool dressing, so that the modulus of transverse rupture and the modulus of elasticity were both reduced to two-thirds of the corresponding moduli of sawed samples.

Mr. Collingwood.—That would seem to show that the results in our text books, which have been produced by very finely dressed specimens, must be very inaccurate if they are only two-thirds of the strength they really possess, when there is no injury to the surface.

Mr. Croes.—I regret to say that I do not thoroughly understand yet the distinction between theory and practice as given by Professor Egleston. These stones which have not been preserved at all, and which have shown disintegration, are stones, as I understand, that have been laid in walls for a long period of time. I may be mistaken, but I have not understood that stones which have been saturated on all sides with such a preparation as the Professor recommends have been tested for any length of time, have been laid up in a wall, and have proven that they will not deteriorate. The processes of preservation that have been applied have been applied to the faces of walls, and have either failed or succeeded, as the case may be, in the instances mentioned. Now, if I am correct in this supposition, that this process of saturation of the stone or impregnation of the stone with an oleaginous substance has not been tested in masonry, I cannot understand how a good bond can be procured in masonry, in which the mortar mixed with water is brought in contact with the oily surface of the stone. I do not believe that it will take a good bond in the absence of evidence to the contrary.

Professor Egleston.—I thought I had made that plain. I intended to state it, that the only successful experiments on the Houses of Parliament were those in which a preserving material had been applied to the whole surface of the stone—that is, all the surface of each of the six sides. The only exception was of those treated with sulphur. Stones have stood for twenty years, the surface of which only was impregnated with sulphur, but these have just commenced to chip in July last., Every other stone that was put into the Houses of Parliament that has not been treated on all its surfaces has failed. Those treated on all their surfaces have not failed.

Mr. Croes.—Have those stones been treated with oil?

Professor Egleston.—They have been treated with oil and substances of that character.

Mr. Croes.—I understood that the stones were treated with sulphur.

Professor Egleston.—That was only on the outside of a portion of one of the buildings, and was done about twenty years ago.

Mr. Johnson.—We have in Ohio a variety of sandstone which is more or less impregnated with saltpetre. What would be the effect of the combination of oil with saltpetre?

Professor Egleston.—I do not know, never having tried it, but I think the effect would be that the oil would be decomposed, as the saltpetre would come out on the surface. So far as my experience goes, the only thing that can be done to preserve stone is to prevent the action of atmospheric influences, those that go from the outside in. If there is anything in the stone to come out it has got to come out. I do not know of any method of preserving stone except to prevent the influence of the atmosphere working from the outside in. Of course it would be quite possible to preserve the stone by taking all the saltpetre out, but it would not be practicable; it would be too expensive.

D. J. Whittemore, M. Am. Soc. C. E.—This impregnating of stone with oils or things of that nature I think is nothing new. I think that Vitruvius, or some of the ancient writers, describes processes for the manufacture of cement by which there was introduced hog's lard or olive oil, and the mortar was used principally for the purpose of lining the aqueducts; and, judging from a specimen of the mortar, it bears out conclusively that such matter was used, as the oily substance has vanished, and it is porous now, more open probably than the ordinary brick. Such substances might, in my opinion, have a temporary effect towards preventing disintegration. As to permanent effect, I think the question is yet to be solved.

F. G. Darlington, Jun. Am. Soc. C. E.—I do not know whether there are any data to show the cost of application of any of the preservatives to any of the stone; and the question arises, whether it would not be cheaper in the first place to pick a stone that would stand the atmospheric influences rather than to take a stone that would not and treat it with substances to preserve it.

Professor Egleston.—There is no question about that, as the stones come from the same quarry, the cheapest and best way is to pick the stone that will stand and reject absolutely every stone that will not stand, and if that was done no sandstones would be used except those having a siliceous binding. It is, moreover, quite possible to fill the pores of the stone, whether they were in the stone in the quarry or have been formed by atmospheric influences, by sulphur or paraffine, which will not decompose. Oil is a

*A paper read before the American Society of Civil Engineers, by Thomas Egleston, Mem. Am. Soc. C. E., and printed in the Transactions.

palliative and arrests decomposition temporarily, but when the gum which it forms is decomposed, the coating must be repeated or the action will commence again.

Mr. Bush.—If I understand the Professor, the treatment that he proposes—that is, oil on the outside of the stone—does not prevent moisture leaving it. If that is a fact he relieves my mind from the embarrassment of the possibility of confining the moisture in the stone.

Professor Egleston.—I did not say moisture. The nitre is nitrate of potash or nitrate of soda. The ordinary nitrate of commerce is nitrate of potash, and there is no power that will prevent its coming out if the materials that form it are in the stone itself. The nitrates, when they exude, will form a soap with the oil, which will be washed away.

Mr. Brush.—It seems to me very undesirable to do anything to stone that would be the same as painting would be to wood. If you confine the moisture it would have a serious effect, and severe cold would break the stone.

Mr. Darlington.—I would like to know what would be the effect of extreme heat upon stone treated with any of those preservatives. If with linseed oil, would not the heat of our extreme summers have the effect of bringing the oil all out?

Professor Egleston.—So far as any experiments have been made, I think it exactly the contrary. The higher the heat the further the oil penetrates the stone. Experiments have been made up to about 250 degrees; not much higher than that, because a higher heat would injure the stone, but the penetration is greater as the heat upon the stone is higher. Small pieces of stone can be treated in the laboratory to this temperature, or even above it, without much danger. When large pieces are treated on the surface by means of a flame thrown on it, the heat must of necessity be applied over moist surfaces, and the danger of damage will always be very great. When the stone is heated by the sun, the temperature will always be very high without danger to the stone, and as the heat has penetrated under such circumstance to a considerable depth, the penetration will be greater than is possible by artificial means, especially in buildings.

C. J. H. Woodbury, M. Am. Soc. C. E.—I have had some experience in the protection of a brick building by the use of a plaster composed of boiled linseed oil mixed with sand colored with red lead, the color after drying being similar to the Portland sandstone. A coat of boiled linseed oil was laid upon the brick wall before the mixture was applied. A covering of this material upon a building has resisted the weather for three years without any chipping, cracking, spotting, or disintegrating of any kind.

Reference was made in the paper to the slates formerly used as grave-stones throughout New England. There is quite a difference in the ability of the product of various quarries to resist the weather.

A number of years ago there was a slate quarry in the southern portion of New Hampshire which was held in great reputation for its headstones, which would wear as smooth as glass upon exposure to the weather, while the production of other slate quarries would wear rough, although slowly.

Mr. Croes.—I saw a statement in one of the New York papers a few months ago to the effect that the surface of the obelisk in Central Park was disintegrating from the effects of this climate.

Professor Egleston.—That is true, and the disintegration is very rapid, but from a different cause altogether. That stone has been exposed for two thousand years to a dry climate at a high temperature, and the disintegration of the granite had already commenced before it came here. It had probably stood for two thousand years, and would probably have disintegrated in two thousand years more; but it has been brought to the very worst climate in the world, I suppose, except Boston, and now any one who goes there after a storm can pick up as many pieces as he pleases, and can get relics very easily. I have very little hesitation in saying that if the obelisk is not placed under some dome, the dome of the Museum of Art, as it should have been in the first place, in twenty or thirty years it will probably be beyond repair.

Mr. Croes.—How large pieces are coming off?

Professor Egleston.—From the size of a pea to pieces several inches long.

Mr. Croes.—On which side of the oeblisk?

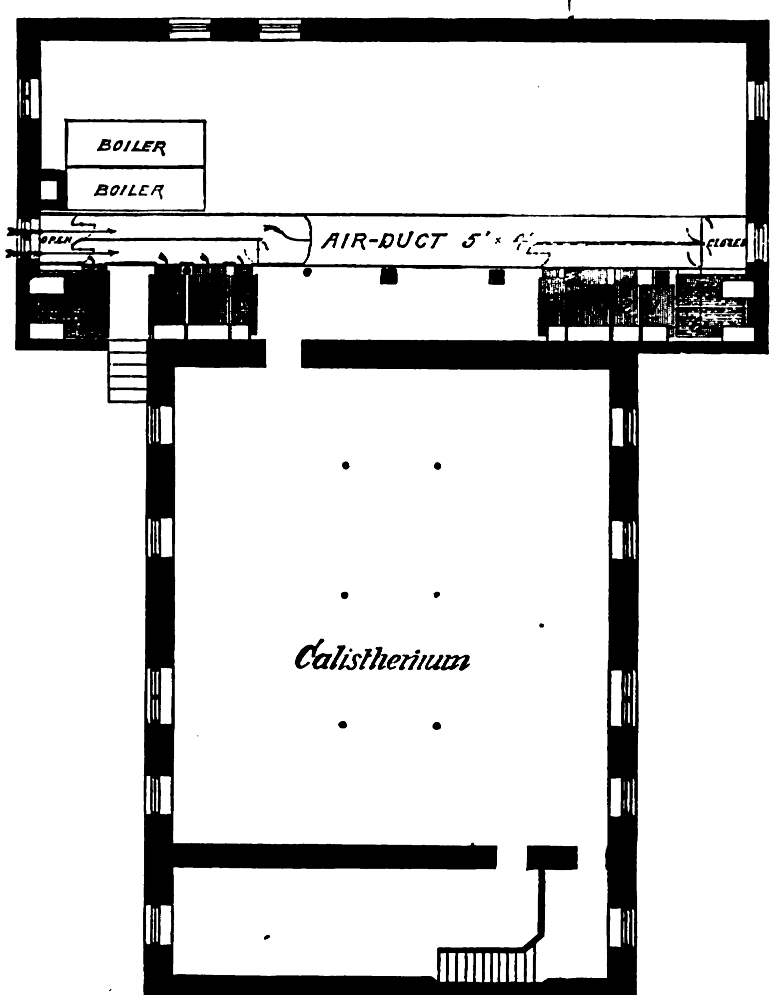
Professor Egleston.—In all directions. It does not seem to be from one side more than another. In regard to the slates of which Mr. Woodbury speaks, I have had the same experience in roofing. The roof of my country place twenty years ago was covered with the best slate I could get from the Canaan quarry. I examined that slate lately and found some of it no better than clay. Some of it had all gone to pieces so that you could crumble it in your fingers. I have not completed my investigation in regard to the causes of the disintegration of slate. I simply wish to call the attention of engineers to the fact that water-proofing alone will arrest the process of decomposition.

Captain Bixby.—The effect of the atmosphere upon granite and other stones is shown very clearly also on iron at Fort Macon, N. C. The fort is of old-style masonry, inside of brick. Many of those bricks that come out to the face of the wall as headers are so soft that you can stick in a lead pencil almost anywhere and take out half an inch of the brick. The iron balustrade going up the side of the steps to the upper parade on the side where the south-east winds can strike it has wasted away under that wind, so that iron bars one inch square in a vertical position have been completely rusted through. Some of them are standing there now in that way. The middle part of the bar is gone, and you can see the evidence of rust and the corroding action of the atmosphere to show that that is the way the bars have disappeared, and not from any other cause.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

THE WARMING AND VENTILATION OF THE HONESDALE GRADED SCHOOL.

To show what can be accomplished, even in an old wooden school building that has been built without reference to systematic ventilation, when the town is fortunate enough to have a school committee who appreciate fully the importance of fresh warm air and plenty of it, we herewith reproduce the engineer's drawings in the case of the Honesdale, Pa., graded school building, which has now withstood the test of winter to the satisfaction of the school commissioners and teachers. The building is in the form of a T, as shown on the plans, with the five lower grades for small children on the first floor. The sixth and seventh grades and academic department occupy the second floor. Originally the building was warmed by coils



BASEMENT PLAN

of direct steam-pipe under the windows on the outsides of the rooms. This was ample for warming the building, except, perhaps, in the very coldest weather.

The recent increase in school population in Honesdale forced upon the board the necessity, as it was thought, of removing the old structure and the construction of a more commodious building after modern plans. The old building had several good points, however. It was in good repair; it was fairly well lighted; it was of the approved height between stories, and had floor-space in all of the rooms but that of the second grade for the proper number of scholars for each teacher.

The ventilation, however, was very deficient, though not entirely overlooked, as there was a flue of about 12x12 inches, with a small register and steam-coil in each, leading from each class-room, and two such flues from the academic department; but there were no systematic inlets, however, of any size for fresh or warmed air, and the teachers and children were always complaining of headache and lassitude, even to the point of fainting at times when the windows could not be opened on account of cold weather. On the school committee, fortunately, was a physician of more than ordinary merit and a Congressman who had heard ventilation discussed before the Senate and House Committees on ventilation, and who had given the subject special attention and study himself, and several others, who, in a general way, understood the subject sufficient to be willing to lay out a reasonable amount of money to obtain fresh air for the benefit of the children under their charge.

The Board of Directors was composed of six members, as follows: H. J. Tarble, Postmaster of Honesdale, President; S. B. Haley, Secretary; Thomas Crossley, Treasurer; Ex-Congressman C. C. Jadwin; Dr. Reed Burns; and Horace T. Mesmer, leading merchant of the place. The three latter gentlemen were the Building Committee, and had in charge, under direction of the board, all matters of improvements and repairs.

The two gentlemen first alluded to studied the question by consulting competent authorities, and concluded that *at least* 500 cubic feet of fresh warmed air per hour should be admitted for each small child in in the first grade—"baby class"—and increasing proportionately to 1,000 cubic feet per capita for the largest ones, as representing the minimum quantity of fresh air that should be provided for; taking Morin as their authority.

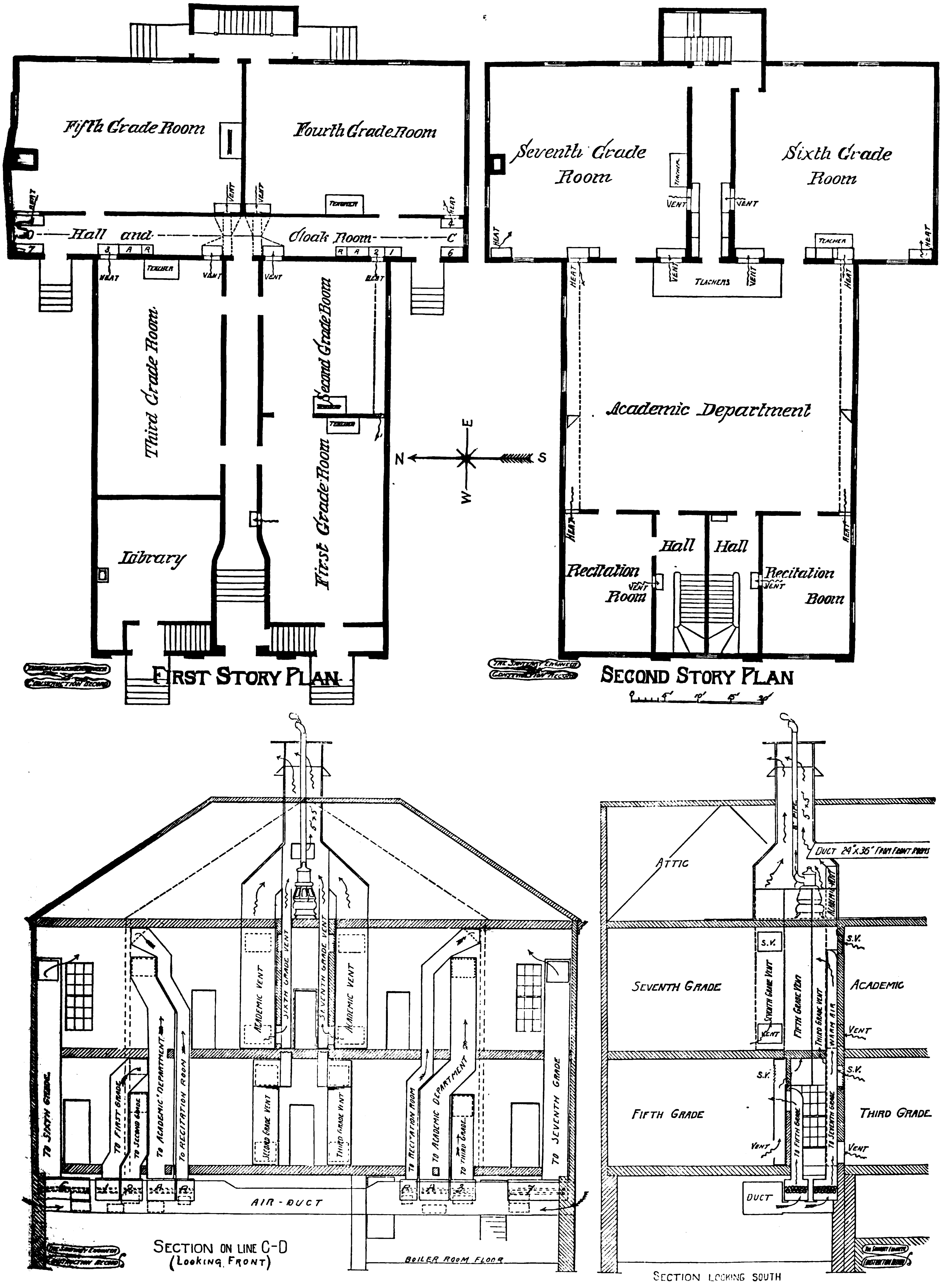
The problem, however, which presented itself was the difficulty of carrying this out properly by any of the conventional methods without destroying the Calisthenium, which had only a height of eight feet, and which could not be filled with coil-boxes or air-ducts. In fact, the problem was to warm and ventilate the building without entering the front basement.

This at first seemed nearly impossible, but after a study of the building it was observed that twenty inches could be taken off the width of the cross hall (marked "hall and cloak-room" on plan of first-story) without materially affecting the hall as a passageway. A corresponding width was required in the sixth and seventh grade rooms, in some places for flues, and this was obtained without affecting the seating or materially diminishing the rooms; as in the case of the sixth grade, the space required was at the teacher's back, and in the seventh grade it took a little off the side aisle, while in the fourth and fifth grade rooms the unused inner corners only were required, and did not affect the seating at all.

This space of twenty inches was required for air and vent flues, eighteen inches wide inside, made of inch matched pine boards, tinned throughout on the inside, the tinning being used for both heat and vent flues alike, several objects being in view: one, the prevention of the spread of fire through the flues; another, the lessening of friction of the rubbing sides of the flues; and last, though not least, to prevent leakage of air to or from the flues through dry cracks and seams in the lumber after it becomes time-seasoned.

The heating-coils are arranged as shown in basement plan, Fig. 1. The warm-air flues start directly out of them; the numbers on the coil-box corresponding to the numbers of the grade, and the letters A A being the academic coils and flues, and R R the recitation-room coils and flues.

The warm air enters the rooms about 7 feet 6 inches from the floor, with the exception of the recitation-rooms and the first-grade room, where it enters close to the ceiling. The positions in these cases were unavoidable, on account of having to carry the air through triangular ducts in the corners of the academic department, near the ceiling, and through the second grade in rectangular duct. There is, however, some question as to whether it is not as good as at the 7-foot level, though the engineer who did the work prefers the latter; his explanation being that the lower the warm air can enter a room, other things being equal, the better the mixing will go on, as under such circumstances it must pass to the ceiling or towards it while



HEATING AND VENTILATION OF THE HONESDALE SCHOOL.

diffusing, and afterwards coming down to go out of the vents, as it is displaced from the ceiling by the constant supply which reaches them. The outlets or "vents" are at both floor and ceiling; the winter "vents" as low down as it is possible to get them, and the summer ones near the ceiling. The registers in the latter have valves, sometimes called slats, with cords and tassels, so as to adjust if required, but all other registers are faces only, the heated fresh air and lower vent-registers always remaining open and without the means of being closed, if any one felt so disposed through an ignorance of their use.

Attention is called to the relative position of inlet and outlet to each room. Two objects are kept in view—one the mixing of the air and the other the equitable warming of the rooms. In this case, however, the latter is of less importance than in rooms that must be warmed altogether by warm currents of air. Here the old direct coils are retained for very cold weather, and as they run on the outside walls under the windows, the cold air does not fall on the children from the walls and windows, but rather moves in the other direction or towards the coils when steam is in them. These coils then act as mixers and must materially assist diffusion, as they establish counter-currents. The inlets were placed, however, with the view of getting the best diffusion possible, and were therefore placed so as to blow the air along outside walls of the rooms, while the vents are in the inside corners or sides at the floors. The circulation from the impetus of entry is then assumed to be around the three long sides of the rooms or in that direction, while the circulation produced by the cooling of the outer walls and glass is a rotary motion, whose axis is the length or width of the room, as the case may be. This gives two motions of the air, one with a horizontal axis and the other with a vertical axis, which break into each other and are otherwise upset by local conditions.

A reference to the cross-section on line C D will show the elevation of all the warm-air flues from the coils and many of the vent-ducts. They are plainly indicated and lettered, and require little comment except to explain that the offsets in the warm-air flues were unavoidable on account of floor-timbers that could not be cut, doorways, etc. The recitation-room flues had to be drawn over the academic flues to reach the corners formed by the ceiling and walls, and in a similar manner the first grade had to be drawn over the second-grade flue.

Some difficulty was experienced to turn the second, third, fourth, and fifth grade vent-ducts at right angles to each other on different floors, but this was accomplished in the cross-hall above the doors, and is shown in plan of first story and in section looking south.

The vent-ducts are all collected into a stove-chamber in the attic, the stove being intended for use at times when steam is not required for the coils. At other times steam-coils in the vent-ducts are used to cause an upward draught, twenty feet of 1-inch pipe in two vertical lengths being used in each flue. In the stove-chamber the side of the vent-flues toward the stove are sheet-iron only, the object being to warm them through by radiation from the stove. The shaft above the stove is 5x5 feet, and all is tinned to the very cap.

The inlet air-duct is 5x4 feet and extends across the building, with a full-size opening at each end. Pivoted doors are used so the prevailing winds may open one end and close the other. The duct is divided longitudinally, as shown on the basement plan, at each end, and secondary swinging doors are used, as shown. The object of this arrangement is to divide the air-current equally at the inlet end for the better distribution and equalization within.

The following table shows the size of registers used, the lineal velocity of the air at register faces, the number of children to a class, the total air passed per hour, and the air per capita per hour as found by Dr. Reed Burns and C. C. Jadwin, two of the commissioners, and William J. Baldwin, M. E., on the morning of 11th of January, when the thermometer registered two degrees above zero.

Grade Room.	Size of register in inches at fret-work.	Square feet in register.	Lineal velocity of air in feet per minute, 2" from face of register.	Seats for children in room.	Air passed per hour—cubic feet.	Air per capita in cubic feet per hour
1	26"x20"	3.5	305.	59	64,020	1,084
2	29"x29"	5.84	260.	52	91,104	1,752
3	"	5.84	277.5	60	97,236	1,620
4	"	5.84	250.	62	87,600	1,413
5	"	5.84	210.	70	73,560	1,051
6	37"x26"	6.66	234.	74	93,480	1,263
7	"	6.66	243.	68	97,080	1,426
Ac.	" }	13.32	246.	125	256,560	2,052
Ac.	" }					
Rec.	26"x20"	3.5	200.	30	42,000	1,400
Rec.	"	3.5	218.	30	45,780	1,526
Totals..	....	60.50		630	945,420	

The cold-air inlet is twenty square feet in cross-section. The foul-air outlet at roof is twenty-five square feet in cross-section. The lineal velocity in the outlet was found to be 625 feet per minute, and the total air going out 937,500 cubic feet per hour, or only a difference of 7,920 cubic feet as measured at the face of the registers in rooms. The coils used are box coils, two pipes high, covered with secondary wire surface; the total surface being between 1,500 and 1,600 square feet.

Air-mixing dampers are used that are controllable from the cross-hall. Thermometers hang in the air-flues within small doors, that the janitor can determine the temperature of the air entering the rooms without entering them. By experiment and observation he knows the heat required to maintain the heat in the rooms, and works the mixing-damper upward or downward with a socket-wrench; the spindle of the damper being flush with the floor. Underneath he has a recording slide that shows the position of the sliding damper and the proportion of cold air he is adding to the hot air as it passes the coils.

Experiments made with thermometers at many places within the rooms, but with special reference to the floor and head-line, show *two* degrees variation of temperature below the six-foot level when the outside temperature was two degrees above zero. This evenness is presumably due to the combination with the old direct coil system, which was not removed, and which is still used in extreme cold weather in connection with the indirect system. At a position in the first grade at the floor in front of a window, where the coldest current would be found, there was less than two degrees difference between it and a thermometer on a post in the middle of the room, six feet from the floor.

The following letter has been received from Professor Twitmyer in reference to the above matter:

HONESDALE, PA., March 11, 1887.

SIR: During the coldest weather in January, when the thermometer registered below zero for a number of days successively, there was no difficulty in keeping all the rooms in the building at an even temperature of 68° Fah. (except the library, which is heated by the old direct-radiation system alone), and at the same time removing the air as rapidly as it became fouled; this has given us a continuous "May atmosphere."

In December the Wayne County Teachers' Institute was held in the high-school room; during its sessions the capacity of the apparatus was very fully tested, as there were frequently for three hours, without intermission, more than four hundred and fifty adults in the room, which is designed to accommodate only one hundred and twenty pupils and four teachers; though four times the quantity of fresh air usually needed for the school had to be introduced, yet the supply was equal to the demand, and it was kept as pure and fresh as at any time during the year. All this has been accomplished with less fuel than was formerly used when the building was heated by direct radiation.

In point of health there has been a decided gain. Both pupils and teachers are doing more and better work on account of the purity of the air; there have been no complaints of headache and *ennui*, formerly so frequent; the children have been in no way exposed to draughts from open doors and lowered windows, consequently have been entirely free from coughs, colds, and catarrhal affections.

Very respectfully yours,
GEORGE W. TWITMYER, Principal.

Mr. C. C. Jadwin, the Chairman of the Building Committee, personally superintended the work. The steam-fitting was done by the Honesdale Iron Works, and the carpenter work by Samuel K. Dodge.

IN his report on the epidemic of typhoid fever at Pierrefonds in August and September, 1886, published in the *Revue d'hygiene* for February, 1887, Dr. Brouardel proves that the disease was spread by the water from wells contaminated by sewage, and the demonstration is carried a step beyond what has been done in previous similar investigations, since the bacillus of typhoid was shown by culture methods to be present in the water used in the families affected by the epidemic.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. XIII.

(Continued from page 488.)

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

TRAPPING OF FIXTURES.

1. After having trapped the soil-pipe where it enters the house, and ventilated it by allowing fresh air to enter at a point just inside the trap and pass out at the roof, is it necessary to trap all fixtures?

Yes. Absolutely necessary.

2. Why?

To prevent the foul air generated in the pipes entering through fixtures, thereby contaminating the atmosphere.

3. What are the usual forms of traps under fixtures?

S and P lead traps. Other kinds are occasionally used.

4. What is the chief difficulty to be overcome with the traps below fixtures?

The liability to syphonage.

5. How is this syphonage prevented?

By a back-air or vent-pipe, which admits air to prevent a vacuum being formed.

6. Is this certain to prevent it?

If the back-air pipe is of proper size it is impossible for syphonage to occur.

7. Does the water ever dry in a trap?

It will dry out by evaporation. Capillary attraction frequently drives out the water in a trap.

8. When a house is closed is there any means by which this can be guarded against?

Yes. By filling traps with crude glycerine evaporation is prevented.

9. Should all traps be so arranged that they can be cleaned?

It is usual to do so with traps for sinks and wash-basins by means of a trap-screw.

10. Should all traps be ventilated?

By all means.

11. Where should this ventilating-pipe be placed?

At the highest point or crown of trap and on the sewer side of trap.

12. Where should it be carried?

To the outer air or to a point above where highest fixture is connected.

13. Is there any objection to carrying the ventilating-pipe into upper part of soil-pipe above the highest fixture?

No practical objection. It may be carried above roof independently in preference.

14. If an independent ventilating-pipe is used for the fixtures, where should it be carried?

Above roof.

15. Is it advantageous to have it larger or smaller at the top?

Larger, as it obviates to a great extent the danger of obstruction by frost, and also presents less resistance to air-supply to fill vacuum.

16. Why?

The necessity of a full supply of air is such that in no other way can syphonage be prevented.

17. Suppose a 1½-inch ventilating-pipe were connected with a sink-trap in the basement of a ten-story house, how large should this ventilating-pipe be at top to avoid friction?

The pipe should be not less than 4 inches from trap to roof to supply sufficient air. Such a pipe should not be put in, however.

18. Where should a trap under a kitchen sink be placed, and why?

As near sink as possible, as pipe becomes foul between sink and trap. This applies to all traps.

19. Should this trap be larger than the waste-pipe?

No.

20. Where should the trap of a kitchen sink, when the waste-pipe passes through the leg of sink, be placed?

As close to the leg as possible.

21. If two or more wash-tubs are placed together, should each tub be trapped, or will one trap do for all?

One trap is quite sufficient.

(TO BE CONTINUED.)

THE cities and towns along the Illinois River and Canal are opposing the passage of the bills now in the Illinois Legislature, introduced at the suggestion of Chicago to further her sewerage plans. The towns have combined their forces and appointed a committee to go to Springfield and work against the bills.

REVISED PLUMBING REGULATIONS FOR THE CITY OF WASHINGTON, D. C.

OFFICE OF THE COMMISSIONERS OF THE DISTRICT OF COLUMBIA,
WASHINGTON, April 22, 1887.

ORDERED: Under the provisions of the act of Congress approved January 25, 1881, the following regulations are hereby made in lieu of section 5 of the existing plumbing regulations:

After the 31st day of August, 1887, no person shall be allowed to engage in the plumbing business or to do any plumbing-work whatsoever relating to the water-supply or drainage of any premises in the District of Columbia, except a master plumber who shall have duly registered according to the following provisions, or an employee of such registered master plumber, working under said master's instructions, for the proper workmanship of which employee the said duly registered master plumber will be responsible.

All registrations of plumbers heretofore made will become void after the 31st day of August, 1887, and from the date of publication of these regulations no plumber shall be allowed to register until he shall have passed a satisfactory examination by the board constituted for that purpose. The board will be in session for the examination of master plumbers on every Wednesday from half-past 7 to 9 P. M. in such office as shall be directed by the Commissioners.

The following will be held as necessary preliminary qualifications of the candidate for registration: To be not less than twenty-one years of age, a citizen of the United States for at least one year immediately preceding his application, and to be certified as a man of intelligence, good habits and character, in separate letters from at least three responsible citizens of the District, none of whom shall be a relative of or connected in business with the applicant.

Each candidate for registration shall make application in his own handwriting, addressed to the secretary of the board, stating his full name, residence and place of business, age, whether married or single, past history and experience in the plumbing trade or business, with whom he has worked, etc. This application must be accompanied by three endorsements as above specified. The board will consider each application at the next meeting after its receipt, and if no valid objection be apparent the candidate will be notified when and where to appear for examination.

In the examination the board shall require written answers to such questions as they deem needful, and oral replies in addition, with graphical problems or illustrations on the blackboard until satisfied as to the candidate's fitness, to be determined by a majority vote of the board.

These questions shall be selected so as to test the candidate's ability to understand the plumbing regulations, to comprehend and sketch plans and sections showing the arrangement of pipes and fixtures, and to properly locate, erect, connect, and support the same; also, his knowledge of such common laws of physics and hygiene as have relation to the proper and safe methods of supplying water to buildings and removing water and sewage therefrom, and of such other matters as the board shall deem essential to properly qualify him to conduct the business of plumbing.

The secretary of the board will immediately after each examination make report to the commissioners in each case, transmitting the recommendation of the board, accompanied by the application, testimonials, and examination papers of the candidate. Upon the return of these papers to the secretary, he will advise the applicant of the decision of the commissioners, with instructions to register it so ordered.

Successful candidates may repeat their applications after an interval of three months, and if again unsuccessful at an interval of not less than one year from the date of the second examination.

Before registering, the plumber must file a good and sufficient bond in the sum of $500, to be executed by two householders of the District, free of encumbrance, to not less than double the amount of the bond, to be approved by the Commissioners, conditioned upon the observance of these and other regulations and laws of the District, and that he will indemnify and save harmless the District of Columbia from all accident and damages consequent upon, or by reason of, any opening in any street, avenue or alley, made by him or those in his employ for any purpose whatever. Said bond shall also be held to guarantee to all persons employing said plumber, a strict compliance with these and all other regulations of the District of Columbia. In registering the plumber will sign his name, with his business and residence addresses in the register. The name and addresses of his indorsers and bondsmen shall also appear on the register opposite or beneath the plumber's name. He will then receive a certificate of registration signed by the Inspector of Plumbing, and countersigned by the secretary of the Board of Commissioners.

It shall be the duty of every registered master plumber to display in a conspicuous position on the front of his shop a sign giving his name, followed by the words "Registered Plumber," all with letters not less than three inches in size, and also to display his certificate of registration in a conspicuous position within his place of business, and to keep such sign and certificate displayed so long as he shall continue in the plumbing business and his name remain on the register. He will also be required to report to the secretary of the board any change in his business or residence address, and during the last week of June of every year, so long as he shall continue in the plumbing business, to renew his signature upon the register. At the same time his bond will be examined, and, if deemed necessary, a new one will be required.

A list of the names and addresses of all registered master plumbers will be published for the information of the public during the first week of January of each year.

Any person who shall neglect or refuse to comply with the requirements of the plumbing regulations when promulgated shall be punishable by a fine of from $25 to $200 for each and every such offense, or in default of payment of fine to imprisonment for thirty days.

Any plumber found guilty of violation of the regulations shall be required to make good his dereliction to the satisfaction of the Inspector of Plumbers, and shall be suspended from registration for such period as the Commissioners shall order, and during the period of such suspension no permits shall be issued to him.

After January 1, 1888, the above rules as to examination and registration will apply also to all journeyman plumbers in the District of Columbia, for whom a separate register will be kept.

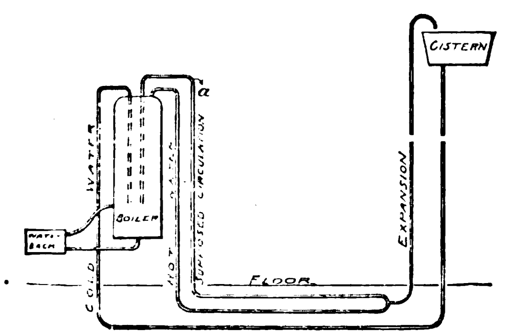
HOT-WATER CIRCULATION QUESTION.

THE following has been referred to us for reply:

ST. JOHN, N. B., April 15, 1887.

SIR: A range-boiler, with cistern, bath, etc., fitted in same flat, is fitted with *circulation*-pipe as per sketch. How can there be a circulation returning to the boiler? As we understand it, the circulation can only be by gravitation. We hold that the tank can have no effect, even if placed on floor above. We can see no use in the circulation-pipe fitted as it is—architects to the contrary. We cannot see that the cistern has any effect. There are rooms between kitchen and bath-rooms through which pipes on walls might be objectionable.

C. E.



[An apparatus such as shown will not circulate, when by the word circulation we allude to the flow of warm water that goes on within properly arranged hot-water pipe from the head of a boiler to some distant faucet and returning again by a parallel pipe called a "circulation-pipe." Therefore, it would be just as well, and would save something in first cost, to omit the pipe *a* in the apparatus shown in the sketch.

The increased height of a tank or cistern above the boiler has little or nothing to do in this case with the question of circulation so long as it remains above the level of the boiler, and the only effect it can have is to increase the pressures in the pipes generally. Anything, however, that will increase the pressure of the water in a properly arranged system will be the means of allowing the water to become relatively hotter before it forms steam, and as an increase of temperature may be assumed to be tributary to the increase of circulation, other things being favorable, a high tank may then be considered as more advantageous than a low one, but this will not apply in this case, as the apparatus will not "circulate."]

STEAM AND HOT-WATER HEATING FOR DWELLING-HOUSES.

ALBANY, N. Y., April 11, 1887.

SIR: I am about building a brick residence, about 55x30, three stories with garret, standing in a block, and am in doubt how to heat it. I have always supposed a furnace was best for a compact house of these moderate dimensions, not exposed, and having no wings or ells; but am strongly urged to use steam or hot water. Could you kindly give me some general ideas on the merits for such purposes of the three methods? In the use of steam or hot water, I should deem indirect radiation indispensable, holding in horror every description of radiator in the rooms of a private house, unless, possibly, in the third floor. Any information or suggestion that may aid me in making the choice will greatly oblige an attentive reader.

H. T. M.

[If the item of first cost is no consideration, entirely satisfactory results may be secured from either a steam or hot-water apparatus. The amount of room required in cellar for heating-coils, and relative cost of apparatus for the particular situation, would, with us, be the main factors in determining our choice.]

ROAD MAINTENANCE.

NEW YORK, April 26, 1887.

SIR: In the matter of the trouble of the City Engineer of Chelsea with his gravel, of which he says, "*it is as well to use beans*," it may be suggested that if used properly it is much better to use than beans.

One of the most difficult things in the world of road-making and repairing is to get roads *maintained*. If that City Engineer allows a hole to form in his road and extend in area and depth till it requires a half a yard of gravel, he must either put enough traffic or work of some kind over the "patch" to comminute from 35 to 40 per cent. of his gravel or add clay or loam to enable the gravel to bond, and make a stable roadbed.

But if he will watch his road and at the first development of a depression water it thoroughly and then add a *thin* layer of gravel, he will find the more difficult the gravel is to bond in a mass the more satisfactorily it will bond and wear in a thin stratum.

MAINTENANCE.

HOW TO OBTAIN THE IVORY FINISH USED ON OLD COLONIAL WOOD-WORK.

PHILADELPHIA, April 20, 1887.

SIR: Noting your interest in old colonial work, I hope you will be able to tell me the most approved manner of obtaining the ivory finish used on that work. I am especially anxious to learn how to obtain the dead gloss found on much of it. Yours truly, ARCHITECT.

[Five to seven coats of oil paint are applied. With the last two Japan varnish and ivory-white are mixed so as to give the polish. Each coat of paint is rubbed down before the next is applied. With the last two coats pumicestone is used for rubbing down. With cherry wood five coats will do; with pine seven are needed to get the same finish.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
April 16.......... ..	26 53	21.04	21.21	30.54	30.23	25.23	32 91

E. G. LOVE, Ph.D., *Gas Examiner.*

THE Edison Electric-Light Company has prepared a plan for a subway for electric-light wires, which is now under consideration of the Commissioner of City Works of Brooklyn.

THE Corporation of Glasgow have advertised for bids for lighting by electricity a portion of the new Municipal buildings, and also the City Hall and Bazaar of that city.

IT is reported that the Edison Gower-Bell Telephone Co. of London has brought action against all of the telephone companies of Belgium for infringement of the patent of the Edison system.

SOME of the stockholders of the Crystal Palace District Gas Company of London are again agitating the question of amalgamation with the South Metropolitan Co., and the *Journal of Gas-Lighting* expresses the opinion that it would be a good thing for all parties.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met April 20, at Washington University, President Potter in the chair, sixteen members and two visitors present, William H. Bryan, Secretary.

Mr. McMath, chairman of the Committee on Resolutions on the death of Captain J. B. Eads, submitted a report. It was directed that the report be spread upon the records of the club, and a copy sent to the family of the deceased.

Professor Johnson made a verbal report of the recent meeting of the Board of Managers of the Association of Engineering Societies at Chicago. The new arrangements made for the publication of the Journal were reported, and its regular appearance in future promised.

Mr. C. W. Clark then read a paper on "Experiments with Submerged Adjutages," describing some experiments made at the University of Illinois. He deduced the results, giving the co-efficient of discharge for each form of adjutage experimented with. The paper was discussed by Professor Johnson, J. A. Seddon, Russell, Professor Gale, and R. E. McMath.

A paper by Colonel E. D. Meier was announced for the next meeting.

ASSOCIATION OF ENGINEERING SOCIETIES.

Board of Managers' Meeting.

PROPOSED CONFEDERATION OF ENGINEERING SOCIETIES.

CHICAGO, ILL., April 15, 1887.

MEETING held in Chicago, President Benezette Williams presiding, J. B. Johnson, Acting Secretary.

There were present Benezette Williams and L. E. Cooley, of the Western Society of Engineers, Chicago; W. S. Chaplin, of the Boston Society of Civil Engineers; C. J. A. Morris, of the Civil Engineers' Society of St. Paul, and J. B. Johnson, of the Engineers' Club of St. Louis.

The Chairman stated the objects of the meeting to be to make a new arrangement for the printing of the Journal; the election of officers of the board; and the furthering of the original objects of the association in the matter of a more inclusive and perhaps a closer union of the several engineering societies of the country.

After a full discussion of these subjects, it was ordered that the proposition submitted by Secretary Prout for the printing of the Journal of the association be accepted, provided that the number of surplus copies of each issue, over and above all takers, shall be at least fifty per cent. of the number taken in the association, and that the remainder of these, on the termination of this contract, shall become the property of the Board of Managers; and provided that the publication shall appear as heretofore, as published by this board; and provided that no article shall be allowed to appear in any periodical before the circulation of the copies of the Journal which contain said article.

The application of the Engineers' Club of Kansas City to become a member of the association was granted, thus making seven societies now in the association.

Chairman Williams and Secretary Prout were unanimously re-elected to their respective offices. It was ordered that the Index Department remain under the general control of Mr. Johnson as heretofore.

Messrs. Williams, Cooley, and Chaplin were appointed a committee to draft an address to the societies now in the association on the subject of forming an organic confederation of engineering societies and to report on the following day.

Adjourned.

CHICAGO, April 16, 1887.

Meeting called to order by the Chairman.

To committee appointed to prepare an address to the societies in the association reported the following:

ADDRESS TO THE SOCIETIES NOW IN THE ASSOCIATION.

"The Association of Engineering Societies was organized some six years ago, its primary purpose being the joint publication of the transactions of the various engineering societies of the country. The movement was looked upon with forebodings by many, while others hoped that the habit of co-operation thus inaugurated would ultimately lead to a broader and closer union, national in its scope. The association originally comprised the societies and clubs located at Boston, Cleveland, Chicago, and St. Louis, with an aggregate membership of about four hundred.* The success attending the association and the enviable status of its publication give abundant promise of permanence and of future growth.

"The Board of Managers has always been disposed to encourage fuller co-operation, believing that there was a growing desire among engineers for a comprehensive organization which should represent them as a whole and as a profession. The efforts recently made in this direction do not seem to be fruitful in results, and we venture to ask that the societies in this association, and all others interested, consider the advisability of taking steps which may lead to a national organization. If this shall appear desirable it would seem best to appoint delegates who may meet and discuss the many questions which must be settled before such an organization can be perfected.

"In the absence of any authority which can act as intermediary, the board offers its services in obtaining the sense of the several societies of the country, and in any other way in which it may aid in this very desirable action. If the societies of the association favor such a movement the board respectfully suggest that it be empowered to issue a call and arrange for a convention.

"In order to arrive at a conclusion in a practicable manner, the following specific proposition is submitted for the consideration of the societies in the association:

PROPOSED ACTION OF THE SOCIETIES.

"ARTICLE 1. The (here insert name of society or club) authorizes the Board of Managers of the Association of Engineering Societies, on the favorable action of two-thirds of the societies in the association, to call a convention of delegates from the several societies of the association and such other societies as the board may invite, said convention to consider the question of an organization of the several societies of the country in a confederation or such other union as may be found desirable. The board is also empowered to lay before this convention such other matters as it may consider of general moment.

"ART. 2. The Board of Managers may determine the time and place for such a convention. The representation of each participating society shall be three votes and one additional for each fifty or fraction thereof in excess of one hundred members.

"ART. 3. The conclusions of this convention shall not be binding upon any participating society until ratified by said society, and when two-thirds of the participating societies have ratified the action of said convention, the proposed organization may go into effect."

The report was adopted and the chairman was directed to send a copy of it to each of the societies belonging to the association.

In matters pertaining to the proposed convention of Engineering Societies, the chairman was authorized to act for the board.

The chairman was authorized to address a letter to the Pittsburg, Denver, Pacific Coast, and Southern Engineering Societies, inviting them to become members of this association.

It was ordered that the official documents of the Council of Engineering Societies upon national public works be published in the Journal.

The chairman and secretary were authorized to levy an assessment on the association to meet the obligations incurred by the contract for printing and other necessary expenses, including the expenses of this meeting.

* Three other societies have since joined and the total membership has nearly doubled.—J. B. J.

PERSONAL.

JOHN F. MOULTON, a prominent railroad builder and manager, died in Cleveland, O., April 26. He built the Buffalo and Jamestown Railroad, and was President of the Buffalo and South-western Railroad before its lease to the Erie. He was also connected with the Brush Electric-Light Company, of Buffalo, in which city he lived.

CITY ENGINEER HASKINS, of Hamilton, Ont., was recently severely injured by falling into a sewer excavation. He is confined to his bed.

THE members of the new Vermont State Board of Health are Dr. Charles L. Allen, of Rutland, Dr. A. H. Chesmore, of Huntington, and Dr. J. H. Hamilton, of Richford.

COMMISSIONER VAN KEUREN has been elected President of the Board of Public Works of Jersey City.

VICE-PRESIDENT PORTER, of the Chicago, Burlington, and Quincy Railroad, has resigned to become General Manager of the Union Pacific System.

SECRETARY WHITNEY, of the Navy, has appointed Captain F. M. Ramsay, Commander Casper F. Goodrich, Lieutenant H. Knox, Assistant Constructor F. T. Bowles, Chief Engineer A. J. Kiersted, all of the Navy, and Mr. J. Shields Wilson and Mr. Edward Burgess, designer of the racing yachts "Mayflower," "Puritan," and "Sachem," a board to pass upon the plans recently submitted for two armored ships.

MR. W. H. TURNER, recently General Superintendent of the New York and New England Railroad, has been appointed Superintendent of the New York Division of the New York, New Haven and Hartford Railroad.

MARBLEHEAD, MASS., has elected as Water Commissioners William J. Goldthwait, to serve two years, John F. Harris, to serve two years, and Robert C. Bridge, to serve one year.

C. M. ROSE has been elected by the City Council of Fargo, Dak., City Engineer of that city.

PROFESSORS BOWDITCH, of Harvard, Mendenhall, of Terre Haute, Ind., and Cook, of Brunswick, Geo., have been elected members of the National Academy of Sciences.

COLONEL W. P. CRAIGHILL, U. S. Engineers, is president of the board appointed to consider the modification of the movable dam built by the Government on the Kentucky River at Beattyville.

MR. GEORGE H. BENZENBERG has been reappointed City Engineer of Milwaukee for the ensuing three years.

MR. GEORGE BOWERS has been appointed City Engineer of Lowell, Mass. Mr. Bowers has been connected with the office for the last twelve years, during which time the City Engineership was held by his predecessor in that office, Mr. George E. Evans.

DR. N. P. BANKS, of Columbus, Geo., has just been elected to the Presidency of the Mobile and Girard Railroad.

MR. GEORGE A. PARKER, an engineer long interested in railroad and bridge building, died in Lancaster, Mass., April 20, aged 65 years. He was engineer of the railroad bridge over the Susquehanna River at Havre de Grace, Md.

MR. JOHN WHITELAW has been re-elected superintendent of the Cleveland Water-Works.

THE President has appointed George M. Sternberg, Surgeon U. S. A., to examine and report upon the question of inoculation against yellow fever.

WARMING CARS BY EXHAUST STEAM FROM THE WESTINGHOUSE AIR-COMPRESSOR.

THE Boston *Post*, of April 12, states that a test was made of what is called the Williams' system of railroad-car heating, with steam from the locomotive, on a train on the Vermont Central Railway. This system contemplates heating the cars by the steam exhausted from the Westinghouse air-brake pump, which has hitherto been wasted. It seems that the steam on leaving the brake-pump, instead of being ejected into the outer air, is taken through an iron pipe into a small reservoir beneath the tender, thence by a similar iron pipe between the cars by flexible rubber pipes down one side of the train to the extreme end and back on the other side to the tender, where the iron pipe is coiled in the tank of the tender, and thence to the vacuum-pump, thus making a circuit. As soon as the train is coupled, the vacuum-pump is set at work. The exhaust-steam from both pumps passes to the reservoir under the tender. There were present at the test Mr. E. C. Smith, Second Vice-President and Acting General Manager; Mr. J. M. Foss, General Superintendent; Mr. William J. Robertson, Superintendent of Motive Power, and Mr. Chase.

STATISTICS, TABLES, AND WATER RATES OF CITIES AND TOWNS. Together with Facts about Water-Meters.

UNDER the above title the National Meter Company, of New York, has issued, in connection with illustrations of meters and gas-engines manufactured by that firm, a very useful publication to commissioners and superintendents of water companies who are interested in dealing with the problem of water waste, besides several illustrations of their own specialties. They publish a statement showing the rates charged for water in the various cities and towns in the years 1884 and 1885, quoted from the Tenth Annual Report of the city of Rochester, by permission of Chief Engineer J. Nelson Tubbs, and they also give the arguments made by the chief engineers of thirty-one water departments in their various reports in favor of the use of meters to check the waste of water. There are also tables comparing the expenses and receipts of the water-works which use meters and those which do not, compiled from annual reports of 1885 and 1886.

PAWTUCKET, R. I., SEWER COMMISSIONERS REPORT.

FROM the second annual report of the Sewer Commissioners of Pawtucket, R. I., we learn that there are 5 miles of pipe sewer and 2 miles of brick sewer, with 178 manholes, 153 lamp-holes, 162 catch-basins, and 17 Rogers Field improved flushing-tanks. The first experience with the flush-tanks was unfavorable, a change of elevation of $\frac{1}{16}$-inch in the syphon being sufficient to prevent its operation. Improvements since made have, however, made them satisfactory. The charge per year for water to the flush-tanks is $10 each.

In July last there were a succession of thirteen distinct explosions of naphtha-gas in one on the sewers, caused by naphtha discharged into an old drain from a manufactory, but no great damage was done.

The cost of new sewers is defrayed by an assessment at first of 50 cents, now of 25 cents per foot front, and one-half a cent per square foot to a line not exceeding 100 feet from and parallel with the street.

Mr. A. R. Sweet is the engineer of sewers, and Messrs. Isaac Shove, Fred W. Easton, and Charles R. Bucklin, Sewer Commissioners.

La Nature of April 2 describes a continuous platform or train, designed by Eugène Heuard, architect-engineer, formed of a series of platform-cars running on a sub-surface track of ordinary gauge and covered by a wide platform raised slightly from the surface of the ground on either side; to be propelled by electricity at a speed of 1.40 m., or 4.6 feet per second, with frequent stops of ¼ minute per minute, to allow elderly persons to walk on or off, younger persons being able to walk on at any time. This is proposed as one of the schemes for the Exposition of 1889. The idea is not very different from that of the continuous elevators used in many of the large office buildings in London, where a double line of small cars is continually moving up and down an elevator-well, and persons walk in and out as they reach the required floor, without any stops.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

PROPOSALS.

(Continued from page 568.)

DREDGING about 16,200 cubic yards. Address New York City Dock Commissioners until May 11.

CONSTRUCTION of two spans of a bridge at Court Street, over the Genesee River. Until May 2. Spans of iron; Whipple cast-iron arch type. Address Thomas J. Neville, Cleik of the Executive Board, Rochester, N. Y.

BIDS for furnishing steam, cast-iron, and lead pipe fittings, etc., also rims, hubs, spokes, felloes and steel, will be received at the Department of Public Charities and Correction, in the city of New York, until May 6, 1887. Indorse "Bid or Estimate for Steam-Pipe, Fittings, etc., and separately for Wagon Materials." Address the Department of Charities and Correction, 66 Third Avenue, New York City.

PROPOSALS for Pennsylvania Industrial Reformatory, and addressed to the undersigned at Huntingdo, Pa., will be received until 2 o'clock P. M., May 3, 1887, for the following work: Outer walls, complete, including turrets, hospital building and stable; plumbing, steam-heating and hot-water supply, boilers, engines, and Bell's telephones; surface-drainage and drain-pipe; cisterns, pumps, mains to reservoir connections, etc.; kitchen and laundry apparatus, complete; electric-light plant; grading and finishing grounds. W. B. Hart, Secretary, Huntingdon, Pa.

BUILDING a hospital and wharf at Widow's Island, Me. Until May 21. Address William C. Whitney, Secretary of the Navy, Washington, D. C.

FURNISHING a centrifugal pump, capable of raising 6,000 gallons per minute to a height of twenty feet, with fittings, etc. Until May 14. Also discharge-pipes 500 feet long. The pump is for a hydraulic dredge. Address Captain E. H. Ruffner, U. S. Engineers, 512 Vermont Street, Quincy, Ill.

FURNISHING and laying 2,500 square yards of vitrified brick paving. Until May 9. Address S. Hazlett, Chief Burgess, Washington, Pa.

CONSTRUCTION of an ordnance storehouse at Fort Canby, Wash. T. Until May 12. Address Lieut. M. F. Harman, A. A. Q. M., Fort Canby, Wash. T.

NATIONAL BRIDGE BUILDERS.

THE association met in Philadelphia, April 22, with the following gentlemen present: William Sellers, of the Edgemoor Iron Company; David Reeves, of the Phœnix Bridge Company; Mr. Jones, of Jones & Brennan; G. Buscaron, of Cincinnati; H. G. Morse, of the Morse Bridge Company, of Pittsburg; Messrs. C. C. Morrison and D. H. Morrison, of the Columbia Bridge Company, of Cincinnati; H. M. Smith, of the Chicago Bridge Company, and Chauncey Andrews, of Boston. Mr. Morrison presided. A report strongly adverse to the Bussey Bridge, which recently fell in Massachusetts, was presented. The Interstate Commerce Law and the comparative merits of hot and cold blast in the manufacture of bar iron and steel were discussed, and the matter of specifications for bridges was considered at length, and C. C. Morrison and G. Buscaron were appointed a committee to report at another meeting.

COMPETITIVE DESIGNS WANTED.

COMPETITIVE designs for the Cincinnati, O., City Hall will be received, until June 1, by Mr. Robert Allison, chairman of the committee. The appropriation is $700,000, of which $200,000 will go to the purchase of the site, etc.

PLANS WANTED.—The Commissioners of Chatham County, Geo., invite architects to submit designs of a court-house building to be located in the city of Savannah. The successful competitor will be charged with the execution of the work at the usual fee of 5 per cent. on cost for plans, specifications, and supervision. Full particulars may be had by addressing John R. Dillon, Clerk, C. C. C., Savannah, Geo.

PLANS will be wanted by the Masons of Augusta, Geo., for a Masonic Temple which it has been decided to build there.

TRADE CATALOGUES.

THE illustrated catalogue of electric gas-lighting apparatus of the Woodhouse & Rawson Electric Supply Co., of Great Britain (Ltd.), Great Victoria Street, London, E. C., has been received, in which quite a variety of appliances for this purpose are illustrated.

THE Connolly Manufacturing Co., 351 Adams Street, Brooklyn, N. Y., have sent us their illustrated catalogue describing the plumbing material and sanitary specialties which they manufacture.

CONTRACTING INTELLIGENCE

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.*

For works for which proposals are requested, see also the "Proposal Column," pages 567-568.

WATER, SEWERAGE, ETC.

CITY OF MEXICO.—The contract for the great drainage undertaking at this city has been given to William P. Humphreys, of San Francisco. The contract amounts to about $8,400,000. The contract calls for roads, bridges, an iron aqueduct, and other work.

DOWNS, KAN.—Water-works are wanted here.

GREENLEAF, KAN.—Address the Board of Trade about water-works here.

BRYAN, TEX.—Water-works are being discussed here.

MATTOON, ILL., will extend water-works.

SEYMOUR, IND.—The bids recently opened for water-works have not yet been acted on. There is a prospect that they will be rejected.

COLFAX, IOWA, will construct a reservoir to hold about 100,000 gallons, and lay 2,000 feet of mains.

THE Waukesha Water-Works Company, Waukesha, Wis., has been incorporated. T. W. Haight and others, incorporators.

LITTLESTOWN, PA.—A system of water-works will be built here. Address E. Myers.

INCORPORATED is the Rockport, Ind., Water-Works Company. Albert H. Kennedy and others, incorporators.

LE MARS, IOWA, is discussing water-works, and it is understood the works will be built this year.

LARAMIE, WYO., will construct a system of sewerage.

JOHNSON CITY, TENN.—C. K. McCollum is interested in water-works to be built here.

HUMMELSTOWN, PA.—Address John J. Nissley about proposed water-works here.

INCORPORATED is the Sedalia, Mo., Water Company. W. B. Quigley, Theodore Plate, and others.

NEWARK, N. Y.—The Board of Trustees have signed a contract with Moffett, Hodgkins & Clark, of Watertown, representing the Newark Water Company, to construct works and furnish water. There will be at least 7 miles of street-mains, 12 to 4 inches, 70 hydrants, and a water-tower 80 feet high and 20 feet in diameter.

COVINGTON, KY.—The trustees of the water-works are preparing to lay new mains and construct a reservoir.

ASBURY PARK, N. J.—The work about to be commenced is an extension to the present system of water-works. It is proposed to put in another pumping-engine, and to sink several additional artesian wells. The Borough has lately purchased a private water plant and a number of driven-wells to be used for sprinkling purposes, thereby more than doubling the present water-supply for fire, domestic, and sprinkling purposes. See our Proposal Columns.

NEW ALBANY, IND.—The Water-Works Company will make improvements in the works, including the laying of new mains. Plans have been prepared.

JAMESTOWN, MINN.—The city has accepted the artesian well. The asylum will expend $4,000 on a water-supply, probably artesian wells.

CARLYSLE, ILL., votes in favor of water-works.

GREAT BEND, KAN.—The franchise for water-works has been granted to J. A. Jones, of Wichita, Kan., and work will be begun at once.

WEST SUPERIOR, WIS., will have water-works.

RUSSELL SPRINGS, KAN.—Address J. E. Hilts, of Russell Springs, about the construction of water-works here.

ROCKPORT, IND.—Incorporated is the Rockport Water-Works Company. A. H. Kennedy, E. E. Wesseter, S. W. Stocking.

ALVARADO, TEX.—Address the Mayor in regard to proposed water-supply from wells.

WAHOO, NEB.—H. S. Dorsey may be addressed about water-works proposed here.

SUMTER, S. C.—The Town Council has made a contract with the George F. Blake Manufacturing Company, of Boston, for construction of water-works. There will be fifty hydrants, and the rental will be $2,500 per annum. We recently gave the details for this undertaking.

GLOVERSVILLE, N. Y.—It will be well to look into water matters here. The proposition for new works, which was voted down last fall, is again revived.

AMSTERDAM, N. Y., will build eighteen miles of sewers. Contracts will be let in May. Luther L. Dean, James H. Winne, and John K. Stewart are the committee to decide on the system to be adopted.

TURNER'S FALLS, MASS.—C. H. Eglee, of Flushing, has the contract for water-works here.

DECATUR, ALA., wants a supply of 5,000,000 gallons of water daily, and is now negotiating with New York parties for the works.

HINESVILLE, GEO.—A movement is on foot here to supply water from a spring near by.

HUMMELSTOWN, PA., Water Committee is discussing plans for water-works. Allen Walton is chairman.

GREAT BARRINGTON, MASS., is discussing the question of water-supply.

WATER-PIPE.—See our Proposal Columns for bids wanted on water-pipe at Rochester, N. Y. The quantity is about eighty-five tons.

ATHOL, MASS., Reservoir Association proposes to enlarge its reservoir. Almond Smith is secretary of the company.

MILWAUKEE.—Bids will be opened May 3 for laying water-mains as per plans and specifications in the City Engineer's office.

Brick sewers will be laid in Hadley Street from Seventh to Eighth Streets, and in Cedar Street from Twenty-seventh Street to Lot 5. Dousman's subdivision pipe sewers will be laid in Twenty-second and Twenty-third Streets, from Cherry Street to Galena Street. Bids opened April 29.

Sewers will be laid in Thirteenth, Fourteenth, Seventeenth, Nineteenth, Twentieth, and Twenty-first Avenues, in Rogers and Union Streets. Bids opened April 29.

ALBION, N. Y., has made a contract with Bassett Bros., of Buffalo, for a system of water-works. The town will pay $3,000 annually.

GRANVILLE, O., will extend its water-works, beginning work immediately.

BATH, N. Y., has in consideration a proposition from the water-works to erect thirty hydrants for $1,200 annually.

MELROSE, MASS., on April 27, voted to raise $20,000 for water-works.

LAWRENCE, KAN., made a test of the new water-works April 21, and accepted them. The contractors were Comegys & Lewis, of New York City.

BISMARCK, DAK.—Water-works negotiations are nearly completed. Cost, nearly $100,000.

ROCHESTER, MINN.—The Council has decided that a competent engineer should be employed to make plans and estimates for a system of sewerage, and that a beginning be made as soon as funds could be raised for the purpose.

MERRILL, WIS., is considering the question of a water-supply, and has received a proposition from a Chicago firm, who propose to construct works at a cost of $77,000, the city to pay an annual rental of $4,500.

BENTON, MONT., will obtain a water-supply, it is reported, from the Telosi River. The project includes an aqueduct tunnel 6,000 feet long. It is said the work will be done this year.

JOHN CITY, TENN.—A company has been organized to build water-works here. A reservoir has been constructed, and 7,000 feet of pipe laid.

MARINETTE, WIS., wants water-works. A proposition has been made by Moffett, Hodgkins & Clark, of Watertown, N. Y.

INCORPORATED is the Jamaica, L. I., Water-Supply Company, with John Lockwood, of Plainfield, N. J., P. S. Swain, A. K. Gregory, and John C. Lockwood, of New York, incorporators.

DE ARMANVILLE, ALA.—A water-works company has been formed here. E. S. Seaman can give information.

HINTON, W. VA.—This town has voted to build water-works, and wants propositions from contractors. Address J. Prince.

SYRACUSE, N. Y.—The Central City Water-Works Company, of which Moffett, Hodgkins & Clark, of Watertown, are principal members, has been resuscitated. An investigation of sources of supply was made a few days ago by Mr. Isaac S. Cassin, C. E., for the company.

CORTLAND, N. Y.—On April 25 the Village Board made a contract with the Cortland Water-Works Company for 120 fire-hydrants at $33.33 each per year.

ATLANTIC CITY, N. J.—Reports in the New Jersey papers indicate that the water company will need new pumping-engines.

EMPORIA, KAN. — Sewerage contractors should watch this city. An agitation is begun to provide a system of sewerage.

GAS, STEAM, BUILDINGS, ETC.

ALBANY, N. Y.—Manufacturers of ventilating apparatus should watch developments here. In the State Legislatuse is a movement to appropriate a considerable sum of money to ventilating the Capitol.

GREENSBURG, IND.—The City Council has appropriated $10,000 to sink gas-wells, to provide gas for manufacturing purposes.

INDIANAPOLIS, IND.—The Indiana Natural-Gas Company has been organized here by the Standard Oil Company, with a capital of $100,000. It is proposed to furnish natural-gas for heating and manufacturing purposes.

HYDE PARK, MASS., will hold a town meeting May 3 to consider the propriety of making a contract with some electric-light company for electric-lamps for street lighting.

WORCESTER, MASS.—The Gas Company will erect a new building, tank and holder, to cost $75,000, after plans by Mr. T. F. Rowland, of New York City. Much pipe will also be laid. The pipe is already contracted for.

NEWARK, N. Y., has made a contract with the Schuyler Electric Manufacturing Company to put electric-lights in the village.

TROY, N. Y.—Address William S. Earl in egard to a proposed crematory here.

DECATUR, ALA.—A. F. Murray is president of the company just formed to sink wells and furnish natural-gas.

SARATOGA SPRINGS, N. Y., wants bids for lighting the streets. There are 378 gas-lamps and 150 kerosene lamps. Address Samuel F. Corry, Clerk of the Board of Trustees, until June 6.

GALVESTON, TEX.—The City Council has rejected the bids recently received for lighting the streets, and new bids will be advertised for.

MOBILE, ALA.—The Progress Electric Company has been organized with S. Rubira, President, and H. W. Shields, Secretary. It will erect a plant for street and house lighting.

TORONTO, ONT. — Building contractors should be on the lookout for proposals for the city buildings. The estimated cost is about $400,000. Architect Lennox is now preparing the specifications.

SYRACUSE, N. Y., proposed to enter into a new contract with the Syracuse Electric-Light and Power Company to increase the number of lamps from 133 to 250.

TOPEKA, KAN.—Building contractors are notified that Kenneth McDonald, the State House Architect, will receive bids until June 1, for the masonry, iron-work, etc., of the main building of the State House. Plans are by McDonald Bros., of Louisville, Ky. The specifications will be ready for bidders by May 4.

RAILROADS, BRIDGES, CANALS.

BROOKLYN.—As the last lot of bids for cleaning the streets are higher than the appropriation, the Commissioner of City Works will advertise again.

BRIDGE.—A bridge will be built over Newtown Creek, Long Island, the cost to be divided between Kings and Queens Counties. It will have a draw fifty feet wide, and will cost not more than $25,000.

INCORPORATED, April 21, was the Dardanelle and Little Rock Railroad of Arkansas. J. K. Perry, James Evans, Thomas Cox, all of Dardanelle, and D. G. Fones, J. B. Miller, T. H. Jones, John G. Fletcher, of Little Rock, are directors.

FORT SMITH, ARK.—It is now settled that the Missouri Pacific will bridge the river at this point.

INCORPORATED, April 21, was the Chicago Terminal Railway and Transit Company to build lines from Chicago to various points in Cook County. Eli H. Cloud, Thomas Caton, John Gray, and others, of Chicago, are the incorporators.

RAILROAD.—The Canastota, Morrisville and Southern Railroad, to connect with the West Shore Railroad of this State, is now being surveyed. Congressman Milton Delano, of Canastota, is Chairman of the Executive Committee.

WINFIELD, KAN.—Two new railways—the Chicago, Kansas and Arkansas and the Missouri and Central Kansas—are projected to this place.

RAILROAD.—The Kankakee, Mendota and Western Railroad was incorporated April 22, in Illinois, to build a line from Kankakee to the Mississippi River.

RAILROAD ENTERPRISE.—The Atchison and Pullman Railroad Companies will build an industrial city on 2,600 acres of land eleven miles west of Kansas City. Factories, churches, school-houses, and dwellings will be erected on the model of Pullman, Ill.

RAILROAD.—The Old Colony Railroad will build an iron bridge at Herring Weir.

THE Minneapolis Stock Yards and Packing Company has been incorporated with the following members: W. D. Washburn, W. S. King, J. S. Pillsbury, W. H. Dunwoody, Thomas Lowry, C. W. Shepherd, H. E. Fletcher, George A. Brackett, A. J. Blethen, S. C. Gale, R. B Langdon, A. H. Linton, W. H. Eustis, and John Crosby, all of Minneapolis. The site selected is in Ramsey County. It is the intention of the company to establish a town site on the line of the Minneapolis, Sault Ste. Marie and Atlantic Railroad immediately at the north, and the yards, slaughtering-houses and packing establishments. An exchange building and bank will be erected.

GRAND RAPIDS, MICH., will have a cable railroad. W. H. Dunham can give information.

SYRACUSE, N. Y.—Incorporated is the People's Railroad of Syracuse to build a street railroad across the city. John C. Keefe, S. H. P. Lathrop, John S. Fredericks, and John Moore, of Syracuse, are among the incorporators.

HARTFORD, CONN.—The New York, New Haven and Hartford, and the New England Railroads, have made a contract for the stone-work of the approaches to the new depot to Mr. Beatty, of Leetes' Island. Mr. Wilson Crosby, of the N. Y., N. H. & H. R. R., is the engineer in charge.

THE Duluth, South Shore and Atlantic Railroad proposes to bridge the St. Lawrence at Morristown, N. Y. The project also includes a new line of railroad to connect with the Boston and Lowell.

MILWAUKEE.—A cable street railroad will be operated on Oneida Street from the lake to the river, across the bridge, and on Wells Street to Third Street, to Cedar, thence westerly on Cedar Street to Western Avenue (the city limits). S. Wohlrab, H. M. Benjamin, William Sanderson, R. & H. Nunnemacher, are the incorporators, and the capital is $1,000,000.

MISCELLANEOUS.

ROCHESTER, MINN.—The iron-work for the new water-works is rapidly arriving, and the engineer in charge of the construction is here. The location of the mains and hydrants has been decided. The contract calls for the completion of the water-works by July 1.

THE bill for a drainage canal by which the Chicago River is to be connected with the Desplaines and Illinois Rivers, has received the indorsement of the joint committee of the two houses of the Legislature, and it is now confidently expected that it will be approved by the Legislature. The act will then have to be voted upon by the people of this city and adjacent towns, as the construction of the proposed canal will involve an expenditure of fully $10,000,000.—*N. Y. Tribune correspondence from Chicago, April 23.*

INCORPORATED is the Ridgway Park Ferry Company, to build a ferry between that place and Philadelphia. Jacob E. Ridgway, George W. Dohnest, of Philadelphia, and Caleb S. Redway, of Columbus, N. J., are incorporators.

ST. PAUL.—Articles of incorporation have been filed with the Secretary of State during the past week as follows:

The Murray Opera-House Company, St. Paul. Incorporators: William P. Murray, St. Paul; Jacob E. Sackett, James M. Wood, Chicago; Enoch W. Wiggins, Frank P. Weadon, Minneapolis.

Duluth Highland Cable-Railway Company, to construct and operate a line of street railway in Duluth. Incorporators: William W. Billson, John H. Harris, Charles E. Shannon, Alva W. Bradley, Duluth; James Bordon, Superior, Wis.; John A. Willard, Mankato; Daniel Shaw, Albany, N. Y.

ELYRIA, O.—In the matter of competitive designs for a soldiers' monument here, the award has been made to Carabelle & Boygani, of the Lakeview Granite-Works of Cleveland. The material will be Westerly granite.

BOSTON, MASS.—The West End Railway Company has made public the details of the proposed tunnel under Boston Common. A bill has been introduced in the State Legislature providing for the right to issue stock to the amount of $12,500,000, the right to tunnel under Boston Common or under Beacon Hill or both, and also giving the company the right to absorb any and all roads doing business in Boston. One plan proposes a route which shall dive under the Common at the Park Street gate, proceeding a little to the right of the historic frog pond, and coming out on Beacon Street at the intersection of Spruce Street. The distance underground will be 1,640 feet. The mean diameter of the tunnel would be about fifteen feet. The average distance beneath the surface on the Common would be six feet. Still another plan avoids contact with the Common even underground by tunneling Beacon Hill, following the line of Mount Vernon Street from Charles to Tremont Street. This tunnel would pass directly under the buildings on Mount Vernon Street, beneath Boston University, Pemberton Square, and have an up-town entrance near Scollay Square. This tunnel would be 2,750 feet long, and would be constructed at a depth below the surface varying from three to fifty-nine feet. There are other plans, but these are given the greatest consideration.

MILWAUKEE, WIS.—Cedar block pavement will be laid on Florida Street and National Avenue.

A large sewer is to be built on Rogers Street.

The Washington Avenue tunnel will be finished from the connecting shaft to the Menomonee River.

Sycamore Street will be paved with cedar Blocks and Third Street with granite blocks.

The Kilbourn Park will be improved and work upon the Juneau Park will begin at once.

Juneau Avenue will be paved from Milwaukee Street to the river, and Detroit Street from East Water Street to Broadway.

The North Avenue brick sewer will be extended along the river bank to a point below the new dam.

Clinton and Reed Streets are to be repaved, and this time granite blocks will be laid down and the rotten wooden pavement removed.

CLEVELAND, O.—The Globe Iron Ship-Building Co. are building one of the largest steamers on the lakes.

NEWARK, N. J.—The City Engineer will advertise for proposals for furnishing the broken stone needed by the city the coming year.

THE Chicago *Railway Age*, in commenting on the unexpectedly large mileage of completed railway construction for the first quarter of 1887, says that from January 1 to April 1 no less than 1,040 miles of new main track have been laid on forty-nine different lines in twenty-five of the States and Territories. This is a larger total than has been recorded for any previous year up to the same date, excepting in 1882, when the construction for the entire year reached 11,564 miles. The article also says: "If the record of recent years forms a basis for estimate, the work of the past three months would seem to indicate that the track-laying for the year 1887 will aggregate from 8,000 to 10,000 miles. But a new element of uncertainty is to be recognized this year—namely, the effect of the interstate commerce law upon new enterprises. The large mileage already laid down is to be credited chiefly to the great railway companies whose arrangements for building branches and extensions had already been made before the law was enacted, and who could not afford to abandon these enterprises, whatever the effects of the law might prove to be."

TORONTO MUNICIPAL IMPROVEMENTS.—The by-laws appropriating $400,000 for new court-house and $350,000 for municipal buildings in one combined structure, and $20,000 in aid of the hospital for sick children, were voted on and carried on the 14th. The vote was a very small one; little interest was manifested in the matter.

The Government have carried a vote to expend $1,000,000 on the new Parliament and Departmental buildings to be erected in this city.

The Board of Works have reported in favor of calling for new tenders for section No. 3 of the River Don improvement. There will be about 200,000 cubic yards of cutting and 138,000 cubic yards of dredging in this section.

The supply of water by gravitation from the high lands to the north of the city is engaging the special attention of Council and Committee on Water-Works.

AN EFFECT OF THE INTERSTATE COMMERCE LAW.—A dispatch to the Boston *Post*, from Keene, N. H., dated April 25, says: "The Interstate Commerce Law has had an unfortunate effect upon the stone quarries at Marlboro. Six thousand tons of paving blocks are standing beside the railroad tracks waiting for some modification in the law. Large contracts had been made for paving blocks to be shipped to Cincinnati at a former profit of 15 cents per yard. The new tariff to Cincinnati increases the rate 50 cents per yard, involving a net loss of 35 cents per yard. Recently an order for 1,000 cars, or 60,000 tons, was necessarily refused under the increased rates."

BIDS OPENED.

JERSEY CITY, N. J.—Bids for cast-iron water pipe were opened, April 20, by the Board of Public Works as follows:

Thomas McKenna, Brooklyn, N. Y., $32.90 per ton for 6", 8" and 16" pipe; M. J. Drummond, of the firm of Fox & Drummond, New York City, $34 per ton for all sizes; George F. Swift, of Brooklyn, N. Y., $38.50 for 6" and 8" and $37 for $16"; John Fox, of Fox & Drummond, New York City, $37.40, for 6", $36.90 for 8", $36.40 for 16"; R. D. Wood & Co., of Philadelphia, $37.20 for 6" and 8" and $35.70 for 16".

The quantities were 900 lengths of 6" pipe, 60 lengths of 8", and 40 lengths of 16".

CLEVELAND, O.—The following contracts have been awarded by the Water-Works Board: Six 36-inch valves and seven 30-inch valves to the Coffin Valve Co., of Boston, price $5,750; stone foundations for West Side pumping-house to Andrew Dall, Jr., $6,975; constructing 250 feet of 36-inch river pipe to the Cleveland Steam-Boiler Works, $4,570; flagging the reservoir lot on West Side to C. W. Stearns, $453.

NEW YORK CITY.—Abstract of bids opened April 22 by the Aqueduct Commissioners for additional shaft No. 12½, section 7.

		Engineer's Estimate.		O'Brien & Clark.		Knapp & Egleston.	
Shaft excavation	125 lin. feet	$150.00	$18,750.00	$140.00	$17,500	$125.00	$15,625.00
Brick masonry for shaft lining	280 cubic yards	10.00	2,000.00	11.00	2,200	11.00	2,200.00
Concrete masonry, 5 broken stone to 1 cement	100 cubic yards	5.00	500.00	5.00	500	5.00	500.00
Concrete masonry, 3 broken stone to 1 cement	75 cubic yards	5.50	412.50	6.00	450	4.50	337.50
Rubble-stone masonry	15 cubic yards	5.00	75.00	5.00	75	5.00	75.00
Shaft filling	475 cubic yards	.40	190.00	.40	190	.50	237.50
Cut-stone granite masonry	10 cubic yards	40.00	400.00	40.00	400	40.00	400.00
Total					$21,315		$19,375.00

INDIANA, PA.—The contract for improvements of the county buildings has been let to J. S. Hastings, of this place, at $51,793.73. The architect is J. P. Leach, also of this place.

NEW YORK CITY.—Bids were opened at the Department of Public Works on April 25, for taking up and relaying pavement in several down-town streets. George F. Doak was the lowest bidder for all the work, and his figures were as follows: Section 1 calls for 9,320 square yards of pavement to be relaid, and 418 square feet of new bridge stones; price, $4,334.64. Section 2 calls for 12,578 square yards of pavement relaid, and 282 square feet of bridge stones; price, $5,111.28. Section 3 calls for 12,025 square yards of new pavement relaid, and 401 square feet of new bridge stones; price, $4,862.23.

LITTLE ROCK, ARK.—The Board of Commissioners for sidewalk improvement, District No. 1, awarded the contract for about one mile of concrete sidewalk to separate bidders, aggregating about $8,200.

BOSTON, MASS.—The Court-House Commissioners have awarded the contract for 20 cast-iron columns to the G. W. & F. Smith Iron Company, at $1,630. Other bidders were the Somersworth Machine Company, $2,256; Davis & Farnum Manufacturing Company, $2,066.90; Builders' Iron Foundey, $1,800; New Bedford Iron Foundry, $1,630.

BOSTON, MASS.—Bids were received April 22, at the office of the City Engineer, for building the abutments of the Wood Island Park Bridge as follows: Boynton Bros., $35,165; Sylvester & Rowe, $28,977 (awarded); Hugh Nawn, $32,724.90.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 23. — PUBLISHED EVERY SATURDAY.

NEW YORK, MAY 7, 1887.

LONDON, MAY 21, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. — IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. — IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

THE RAG-DISINFECTION LITIGATION.

THE suit of Messrs. Lockwood & McClintock against Bartlett & Co., of this city, and Health Officer Smith, of the port of New York, has resulted, after several days' trial, in a verdict against Bartlett & Co. for $8,000, which is about $3,000 more than the value of the rags. In the case of Health Officer Smith, who was charged with corrupt conspiracy with Bartlett & Co., the jury disagreed. Messrs. Bartlett & Co. were proprietors of a storage warehouse and also of a patent process of disinfection with which many of our readers are quite familiar, since attempts were made at the last two meetings of the American Public Health Association to secure an indorsement of the proposition that it was necessary to treat rags by this process in order to prevent the introduction of cholera by means of imported rags; which effort, however, failed. Elsewhere in this issue we print an abstract of the testimony of Health Officer Smith as reported in the *Paper Trade Journal*, from which source the following abstract of Judge Ingraham's charge is also taken:

"The law was clear as to the ownership of the rags. They belonged to the plaintiffs, and they were entitled to their property. The defendants got possession of them and claimed a lien for services. As a matter of law, Bartlett & Co. had no right to retain possession of the goods. The powers of the Health Officer of this port exceed those of any other officer in the State, but he is not empowered to take imported goods and turn them over to a third person for disinfection or any other purpose. He has power, and it is his duty to disinfect infectious importations, but it is also his duty to superintend that work. There was no evidence in this case that the Health Officer performed his duty, and it is clear that the defendant, Bartlett, had no authority to hold plaintiffs' goods. In view of these facts the jury should find a verdict against Bartlett for damages suffered by detention.

"As to the liability of Health Officer Smith and the allegation of conspiracy, the jury should find by fact and inference whether he did his duty and whether he acted in good faith. His duties were plainly defined and he should have the benefit of every doubt. Combinations and conspiracies are quickly made, and actual proof is difficult to obtain. It is proved by inference and testimony as to the subsequent acts of the defendants. If the jurors became satisfied that the acts of Smith and Bartlett indicated a private understanding or arrangement, a verdict against both was inevitable. They were to be satisfied that Dr. Smith's acts were inconsistent with an honest performance of public duty, and that was to be determined in a common-sense manner."

This case will doubtless be carried to the Court of Appeals, since the verdict of the jury under the judge's charge has a very important bearing on the liability of warehousemen in certain contingencies, and also on the liability of these particular defendants to all importers whose rags they have treated with their steam process. Whatever may be the final result of this litigation we imagine that Bartlett & Co. will conclude that the patent disinfection of rags is not a profitable business undertaking, and they will not care to assume any more liability by detaining cargoes of rags, even if sent to them by Health Officer Smith for this purpose; though, for that matter, the shipment of rags to this port has practically ceased, since for some time they have been sent to ports where this disinfection has not been required. We are not among those who believe that Dr. Smith had any pecuniary interest in this disinfection business, though it looks very much to us as though, feeling the necessity at a time when a cholera scare was pending of doing something to prevent the indiscriminate importation of rags, he was induced to believe that this was the most effective process of those submitted to him for destroying infectious matter in rags, and after he had come to that conclusion he was very glad to be able to send business to his personal and political friends, who were or had become owners of the process, that they might make what they could out of it. The disagreement of the jury, however, leaves Dr. Smith in a very unenviable position, and such an one as the Health Officer of the Port of New York should not be placed in, since it is quite clear that a portion of the jury were unable, from the evidence submitted and the appeals of the lawyers, to take the charitable view of the matter that we have here taken.

CINCINNATI CITY-HALL COMPETITION.

IT is proposed to build a new City Hall in Cincinnati, and the Board of City Hall Trustees, it would seem, have decided on their architect, though they have, for appearance sake, instituted a competition, and have issued an invitation to architects to furnish designs for the building in competition. They have in their offer to architects treated the matter as might be expected from a committee of laymen who want a town hall in a community that has no better building than a $1,000 frame structure planned and erected by a carpenter. They ask that the designs include ground and floor plans of each story, and an elevation of the four fronts of the building, longitudinal and transverse sections, all drawn to a scale of one-eighth of an inch to the foot, the building not to exceed in cost $600,000. The designs are to be submitted by June 1. For these the board proposes to pay to each of the authors of "the five best" designs the sum of $300, and they will in "their discretion" pay to the parties submitting the plan which is by them accepted a sum not to exceed $1,500, which is one-quarter of one per cent. on the cost of the building, or will employ such parties as architects in the erection of the building. They make the further liberal offer of agreeing to return the designs to the authors. It remains to be seen whether any member of the Western Association of Architects, or any other association, will facilitate the employment by these trustees of the architect they want, by contributing to this so-called competition.

THE United States consular reports for March include an interesting article by Mr. J. Schoenof on the "Price of Gas and its Cost of Production in England." This report, which contains a large amount of statistics, gives the comparative working of, first, the Stoke-upon-Trent works; second, the average of fifteen metropolitan works, including the three large companies of London, with twelve suburban companies; and third, the average of nineteen provincial companies, nine of which are corporation works. The third class includes the cities of Birmingham, Leeds, Manchester, Nottingham, Bristol, Liverpool, Newcastle-on-Tyne, Sheffield, etc.

The loan and stock capital of the fifteen metropolitan works is 13*s.* 4½*d.* per 1,000 feet of gas sold, while of the nineteen provincial works it is 12*s.* 10*d.*

In the case of the metropolitan works 92.79 per cent. of the gas made is sold, and 6.03 per cent. is unaccounted for, while with the provincial works these figures are 92.25 per cent. and 6.9 per cent.

The metropolitan works, with 3,756 miles of mains, have 344,618 consumers, and sell 61,430 feet of gas per consumer. The provincial works have 4,520 miles of mains, 518,428 consumers, and sell 33,797 feet of gas per consumer.

With regard to residuals, the metropolitan works make 10.45 gallons of tar and 12 cwt. of coke per ton of coal, and use 23 per cent. of the latter for fuel. The provincial works make 12.3 gallons of tar and 12 cwt. of coke, and use 35.5 per cent. of the coke for fuel.

The report gives a detailed statement of the cost of production, which further on is summarized as follows: In the fifteen metropolitan works the cost of coal per 1,000 feet of gas sold is 36.06 cents, the residuals sold being 19.82 cents, making the net cost of coal 16.24 cents. The cost of manufacturing the gas, including carbonizing, purifying, wages, etc., is 18.08 cents; and the distribution, which includes wages, wear and tear, general management, taxes, bad debts, etc., costs 11.44 cents.

These two items, with the net cost of coal, make the total cost of 1,000 feet of gas 45.76 cents.

In the case of the nineteen provincial works the cost of coal per thousand feet of gas sold is 28.84 cents; value of residuals, 14.70 cents; net cost of coal, 14.14 cents. The cost of manufacture is 15.48 cents; distribution, 8.06 cents; total cost of gas, 37.68 cents.

The average price of gas sold by the metropolitan works is 3*s.* 1.73*d.* (75.46 cents), and that of the provincial works is 2*s.* 5.25*d.* (58.50 cents). With these figures, the gross profit is 29.70 cents per thousand feet in the former case, and 20.82 cents in the latter.

OUR BRITISH CORRESPONDENCE.

The City and Southwark Subway—Houses of the Poor Illustrated at a Bazaar.

LONDON, April 20, 1887.

THE City and Southwark Subway, now in course of construction, is novel, both as an engineering scheme and in its method of construction. Its object is to afford a rapid means of communication between the city and Stockwell, a total distance of rather more than three miles, the course of the subway taking it under the Thames. To afford this communication, excavations are being made, and twin tunnels, each ten feet in diameter, are being laid down. An object sought, and so far attained, is to lay the tunnels in such a manner that they shall not disturb any existing rights of property, such disturbance, of course, entailing compensation expenses. The tunnels run, therefore, in some instances, side by side, and, where necessary, the one over the other. To minimise working expenses, they are in the stations (of which there will be four) in the latter position, so that one set of lifts and staircases shall suffice for arriving and departing passengers. Motive-power for drawing the trains will be provided by a continuous wire rope, worked from a fixed station about half way between the termini. The carriages at either end of the train will be provided with grippers, to engage this rope when necessary, the release of the rope and application of brakes, of course, bringing the train to a standstill. It is anticipated that the current of air created by the suction consequent upon the moving train will afford the necessary ventilation, without resorting to artificial means. The up and down lines being totally distinct, each in its own tunnel, there will be no cross-currents neutralizing each other. There will also be no locomotive generating sulphurous fumes. The tunnels are laid down in sections of iron rings 1 foot 7 inches long. To effect the necessary excavations for laying down these rings, there is a cylinder six feet long, terminating at one end in a shield-plate having a cutting edge and attached to hydraulic rams abutting on the last section of ring laid. The open end of the cylinder slides over the 10-foot rings (like a cap), being therefore of a slightly greater diameter. A certain portion of the clay from in front is removed, for which purpose there is an aperture in the cylinder, after which the shield and cylinder is thrust forward by rams. The extra diameter leaves an annular space of about an inch around the iron rings of the tunnel proper, and the filling in of this space is a feature in the construction. It is filled in with grouting mixed in a closed vessel by paddle worked from without. Compressed air with a pressure of thirty to forty pounds is introduced into this vessel and the grouting is fed by a hose attachment through holes in the rings, until the annular space is filled with cement, providing thereby against subsidence either of tunnel or soil. The cost of the subway, together with rolling stock, etc., is estimated at about £550,000 ($2,640,000), and the engineer is J. Greathead, Victoria Chambers, Westminister.

Not many good things come from a bazaar, but the Roman Catholic clergy in Southwark are certainly doing work of service to the community in connection with a bazaar now being held. They are exhibiting a representation of a section of a court in Southwark, whence the occupants were only a short time ago disturbed by the Metropolitan Board of Works, in all its squalor, both the exterior and the interior of the houses being shown.

SAFETY VALVE.

A STABLE AND STORE IN WASHINGTON, D. C.

OUR SPECIAL ILLUSTRATION.

A HOUSE AT HACKRIDGE, ENGLAND.—R. CREED, ARCHITECT.

OUR VIGNETTE ILLUSTRATION.

A STABLE and store at Washington, D. C. The architect's name is not known to us.

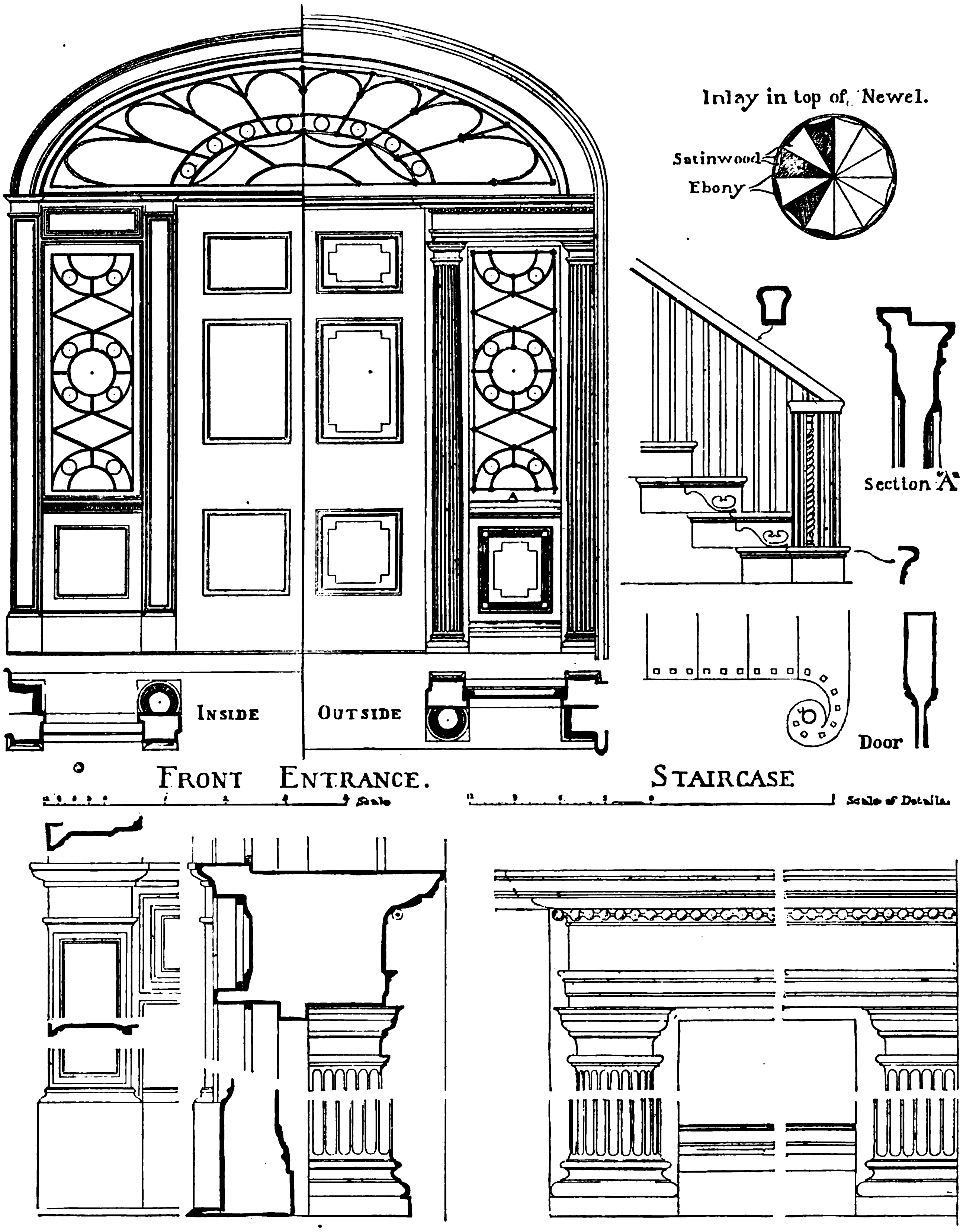
OUR SHEET OF DETAILS.

OUR detail sheet, the tenth in the series, shows details from house at Dorchester, Mass. Date, about 1800

THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

A RESIDENCE AT HACKRIDGE, ENG.

R. CREED, ARCHITECT.



DETAILS FROM HOVSE AT DORCHESTER MASS. DATE ABOUT 1800.
Measured and drawn by W.H. Brainerd.

ENGINEERING & ARCHITECTURE

RECENT SEWER CONSTRUCTION.

No. V.

(Continued from page 458.)

THE IMPROVED SEWERAGE SYSTEM IN NEWARK, N. J.

[Prepared for *The Sanitary Engineer and Construction Record* by F. COLLINGWOOD, M Am. Soc. C. E. and M. Inst. C. E.]

THE city of Newark is situated on the westerly bank of the Passaic River near its junction with Newark Bay, and occupies an area of about 13,000 acres. A ridge running approximately north-west and south-east divides the drainage into two portions, such that 5,188 acres drain through sewers already built into the Passaic, and 7,531 acres drain through other sewers into small streams emptying into Newark Bay. The following table gives the lengths of existing sewers and the tributary area:

Table I.—Data on which computations were based.

SEWERS DRAINING IN MEADOWS.

SEWERS.	Areas in acres.	Distances on present sewers—feet.	Grade of bottom of existing sewers at point of interception by new sewers below mean high tide.
1. Peddie Street	1,157	3,020	—3.50
2. Pennsylvania Avenue	273	2,380	—2.50
3. Murray Street	208	2,330	—1.03
4. Tenth Ward Ditch, McWhorter	159	500	......
5. First Meadow sewer	241	1,042	—3.00
6. Jefferson Street	115	......	
7. Second Meadow sewer	190	1,750	
8. Sandford Street Junction	4,270	2,200	
9. East Branch	918	1,200	
10. Pumping station	7,531	14,422	

SEWERS DRAINING INTO PASSAIC RIVER.

1. Woodside	1,200	3,800	.. ..
2. Fourth Avenue	164	1,350	+2.00
3. Clark Street	64	680	+7.00
4. Mill Brook	1,715	700	—2.30
5. Ballantine's Dock	223	2,890	+4.50
6. City Dock	562	3,015	—5.00
7. Jackson Street	342	5,285	—4.00
8. Sandford Street Junction, East Branch	918	......	......
Total	5,188	17,720	

On the south-west boundary of the city is a little stream called Bound Creek, and into this the Peddie Street and Pennsylvania Avenue sewers poured a large amount of filth. The Murray Street sewer emptied into Wheeler Creek, and that into Bound Creek; also, the Tenth Ward ditch and Jefferson Street sewer emptied into Dead Creek. As the whole southern part of the city bordering on the Bay and Bound Creek are salt meadow and liable to overflow at extreme tides, and the creeks mentioned run some three miles through the meadows and are sluggish and totally unable to carry off the sewage matter thus thrown into them, this state of things was rapidly creating an unbearable nuisance.

The first attempt to improve this condition of affairs was to dig a ditch (called after the originator of the scheme Lister's ditch) from a point near the Pennsylvania Railroad on Peddie Street to the Bay, a distance of about three miles. This had a section of about 6x25 feet, with gates at the railroad end for holding back the contents until about an hour before low tide, when the gates were raised and the sewage discharged with a head of 2½ to 4 feet. To aid the flush a parallel flushing ditch was dug about 3,000 feet to Maple Island Creek. This had gates at the lower end for retaining the water at high tide, and this water was also discharged through the long ditch. As might be expected, the system proved a failure. Although the flushing-wave at the beginning had a crest several feet high, this rapidly diminished, so that Messrs. Adams and Hering compute respecting a similar design that "the mean velocity would be less than sixteen inches per second, which is insufficient to flush away ordinary sewage matter, and even this velocity could be preserved at best only about an hour at each tide. During the remaining time the difference between the water-levels * * * would be still less, and therefore also the velocity, and during incoming tide the sewage would completely stagnate in the ditch and deposit much of its suspended matter. * * * The silt also would have to be frequently cleaned out, not to speak of the dredging required from caving in of the banks," etc.

As a matter of fact it was found that the flushing effect was entirely lost within a 1,000 feet from the gates at the head of the ditch, and the bulk of the heavy matter was dropped within 200 feet.

After a year or more of agitation of the subject in 1884 the Common Council took up the matter in earnest. Meantime Mr. J. S. Schaeffer, the then City Surveyor, had made a careful study of the subject and presented a comprehensive scheme for the treatment of the difficulty.

Mr. Schaeffer compiled the data given in Table I., including the grades or extreme depths of present sewers given in the fourth column. He also gauged the flow in the existing sewers at a time when it was comparatively dry and no rain falling, obtaining the results given in Table II.

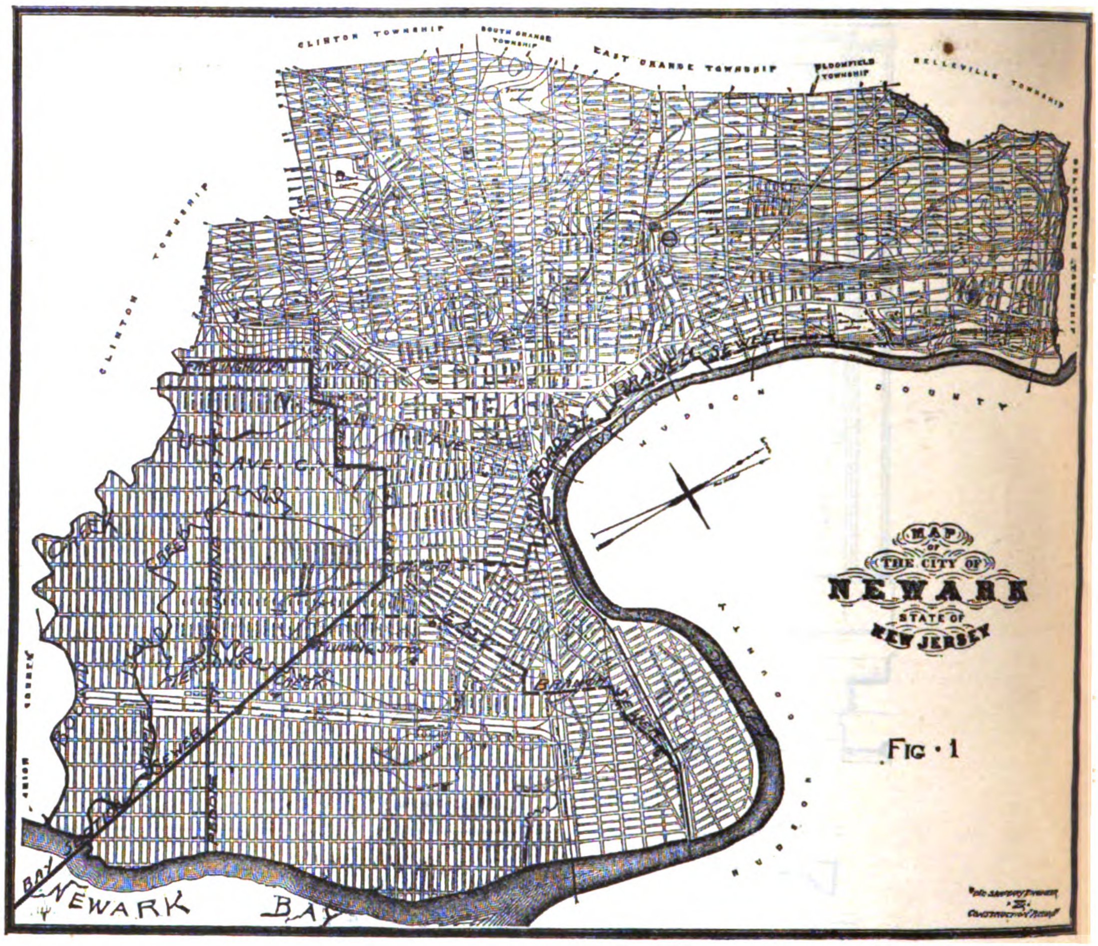


FIG. 1

Table II.

SUMMER FLOW OF SEWERS, NOT INCLUDING RAINFALL.

Peddie Street sewer,	7.86	cubic feet	per second.
Murray " "	0.91	"	"
Tenth Ward "	2 07	"	"
Jefferson Street "	0.17	"	"
	11.01		
Fourth Avenue sewer,	1.54	"	"
Clark Street "	0.36	"	"
Clay Street "	10.24	"	"
Rector Street "	7.11	"	"
City Dock "	10.61	"	"
Jackson Street "	4.14	"	"
	34.00	"	"

	Cubic feet.
Amount of sewage running to the Salt Meadows	11.01
Amount of sewage running to the Passaic River	34.00
Total	45.01

He then assumed a rainfall of ⅜ of an inch in 24 hours over the whole area of the city in addition and laid out three intercepting sewers which should be capable of removing the quantities thus obtained. These were to meet and connect with twin deposit sewers each 250 feet long, which should lead to a pumping station on the edge of the salt meadow. Here the sewage was to be pumped to a sufficient height to be effectively discharged under head at all times into the bay. Mr. A. Fteley was engaged as consulting engineer and endorsed the plans submitted, and later on they were emphatically endorsed by Mr. Julius W. Adams and Mr. Rudolph Hering. Finally, September 19, 1884, the Council passed the ordinance providing for the construction of the discharge sewer and that portion of the intercepting sewer taking the sewage that would otherwise drain across the meadows, and later on Mr. Schaeffer was made Chief Engineer and superintendent of the work, with Mr. A. J. Zabriskie as assistant and Mr. John B. Morris in charge of office-work. November 24, 1884, a contract was let for all the work of construction of this portion to B. M. & J. F. Shanley at the gross sum of $299,964.92 based on the quantities given by the engineer. Final payment, however, was to be made on the lineal feet of trench excavated and refilled; for additional excavation for extra width of trench; for the amount of lumber used, the amount of piling, of brick-work in cement, of rock excavation, of concrete, etc., and also for foundations of pumping station. In May, 1885, the pumps were contracted for with Messrs. Watts, Campbell & Co., for $53,450, including the boilers and setting and the brick chimney. The same parties are to furnish a feed-water heating apparatus for the pump-house at $4,000. Subsequently contracts were made for buildings at $8,913; four stop-gates, $2,200; iron discharge-pipes, $3,000; filth cages, about $1,500; machinery for hoisting filth cages, $1,400; right of way (new street) and for pumping station, $16,977.

These sums make a total of $391,000, but the cost has been greatly increased by the very bad ground met with through much of the route, involving heavier foundations, wider trenches, the wasting of the lower line of sheeting planks, etc., so that the final cost will be about $600,000. The location, lengths, sizes, and grades of the various sections of sewer are given in Table III. and the construction is illustrated in Fig. 2, where the sections are numbered to correspond.

Omitting the 500 feet of deposit sewer, and the wooden boxes for discharge to the bay, the total length of brick sewer constructed is 13,941 feet.

The twin boxes from the pumping-station to and in the bay each measure 11,483 feet, of which about 2,000 feet are laid under water in the bay itself so as to reach the tidal channel.

The old sewer-outlets will be retained and suitable overflows provided for any excess of storm-water. Suitable gates at each intake will be provided for regulating the amount of storm-water to be admitted to the intercepting sewer. By this means the first part of the water from any storm, containing most of the filth from the streets, will pass down the intercepting sewer and be carried to deep water, and the excess entering later will be discharged through the old channels. To have made provision for more storm-water would have involved increased cost, and would have probably prevented the enterprise from being carried out.

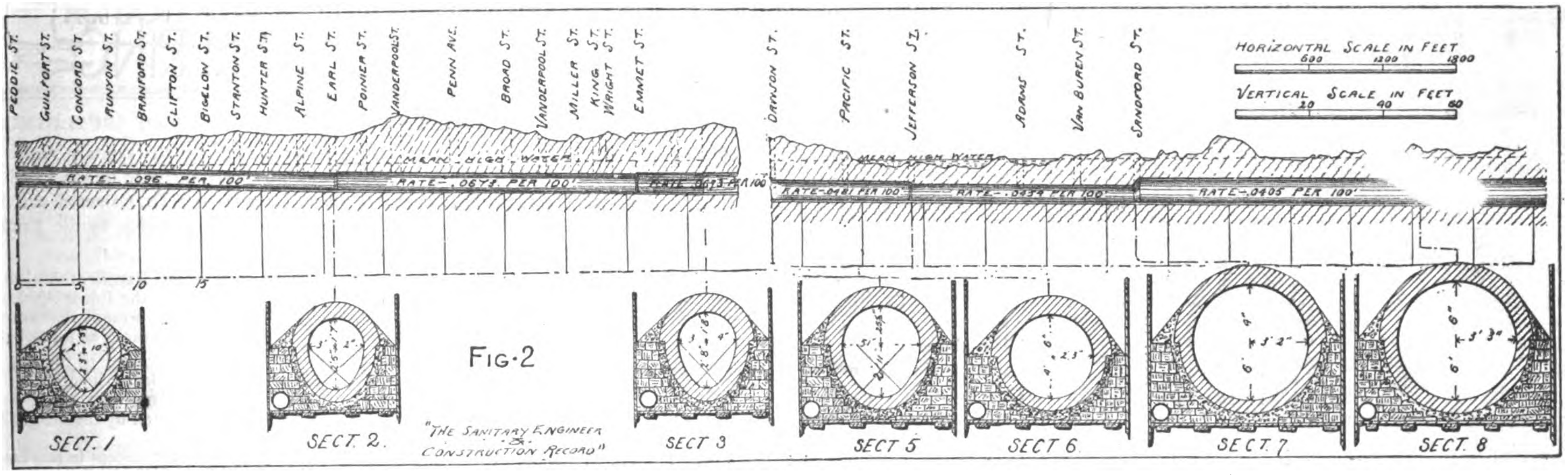
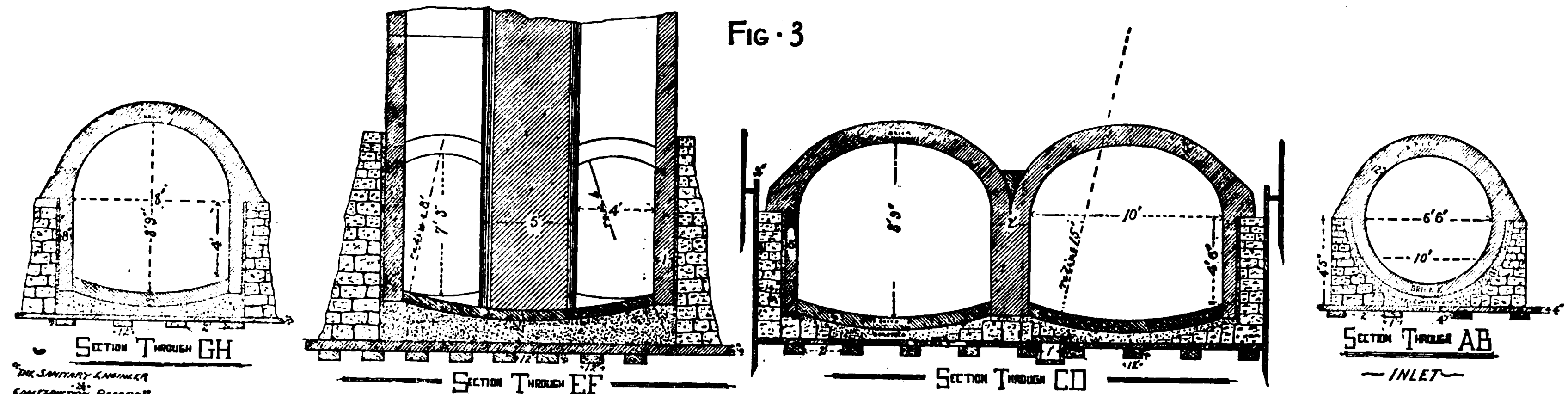
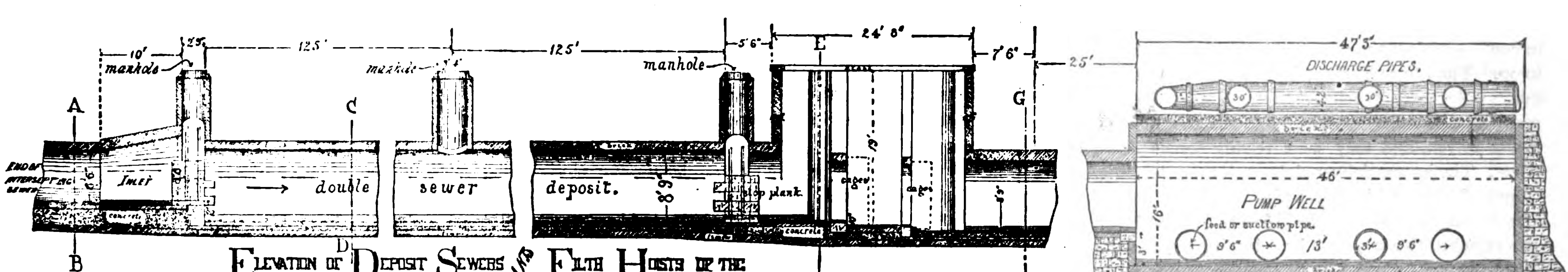


FIG. 2

FIG. 3



SECTIONS ACROSS TWIN DEPOSIT SEWERS, FILTH HOISTS &c.



ELEVATION OF DEPOSIT SEWERS AND FILTH HOISTS OF THE NEWARK'S IMPROVED SEWERAGE SYSTEM.

FIG. 4

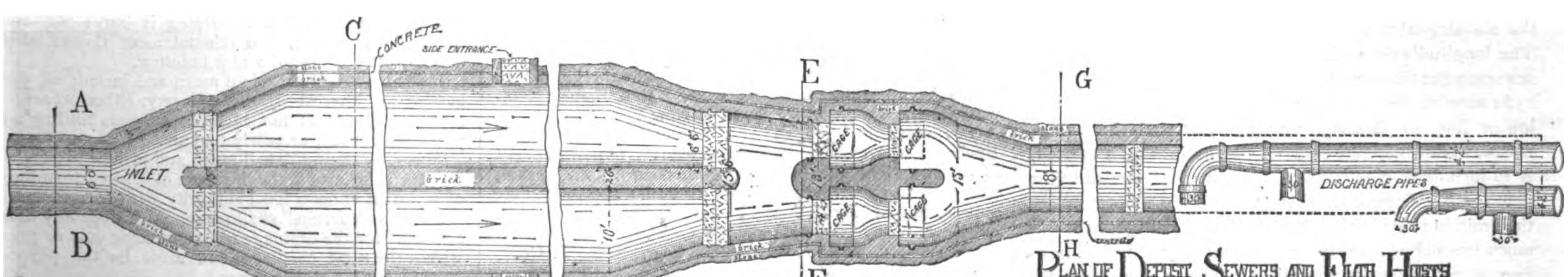


FIG. 5

PLAN OF DEPOSIT SEWERS AND FILTH HOISTS

NEWARK'S IMPROVED SEWERAGE SYSTEM.

Table III.

Section.	From	Through	To	Size.	Lineal feet.	Grade per 100 feet.
1	Peddie St.	Frelinghuysen Ave.	Earl St.	2'10"x3'8"	2,598	.096 ft.
2	Earl St.	Frelinghuysen Ave., Vanderpool St., N. J. R. R. Ave.	Emmett St.	3'2"x4'	2,481	.0673
3	N. J. RR. Av.	Emmett St.	Ave. B.	3'4"x4'4"	1,111	.0673
4	Ave. B.	Emmett St.	Ave. C.	3'8"x4'9"	825	.054
5	Emmett St.	Ave. C., Dawson St., South St.	Jefferson St.	4'3"x5'1½"	2,680	.0481
6	Jefferson St.	South St.	Sandford St.	4'6" circular.	1,184	.0454
7	Sandford St.	South St., Bay Ave.	Ave. I.	6'4" circular.	2,035	.0405
8	Ave. I.	Bay Ave.	Deposit Sewer.	6'6" circular.	1,027	.0405
9	Twin Deposit Sewers to Pumping-Station			10'x8'1½"	250	level
10	Twin Discharge Sewers to and into Newark Bay, each			4'1"x4'1"	11,483	about 1 ft. per mile.

The $2\frac{6}{10}$ miles of the intercepting sewer now provided will furnish a reservoir, which will have to be filled up in every storm before the overflows will come into play, and any increase in capacity of the sewer is of questionable necessity, besides largely increasing the expense of pumping.

The total daily flow for this section of the city is calculated at about 10,000,000 gallons from house-drainage. The daily flow from the storm-waters allowed for would give about 20,000,000 gallons more, so that the maximum amount to be pumped at present will be about 30,000,000 gallons per day.

Passing to a more particular description of the work, let us take up the sewer sections and constructions. Owing to the great amount of ground-water, and the presence of quicksand for a great portion of the line, it was found desirable to use a timber or plank foundation. The trenches varied from 15 to 20 feet in depth. This required two lengths of sheeting plank. The lower one would be cut from 7 to 8 feet long, braced across at top, middle, and bottom; 2-inch sheeting planks were used throughout, and in the worst portion of the work these were tongued and grooved. The attempt to drive the short lower sections in the ordinary way was a failure.

The method finally adopted was to place a line of them in contact against the rangers to the number of perhaps 25 to 40. Then to keep them in line two lines of temporary guide-wales were "tacked" to the braces. When all was ready a jet of water was played at the foot of each one as it was driven, and they were readily forced down about 5 feet. The jet was delivered through a nozzle of some 6 feet length of about ¾-inch gas-pipe (the lower end of which was drawn down so that the hole was ⅜ of an inch). This was attached to a 2½-inch hose leading from a hand force-pump worked by two men. The nozzle was moved from edge to edge of the plank so as to keep the sand in motion, and the driving was rapidly accomplished. This method kept the edges in perfect contact as well as the planks in line, and saved all splitting of plank.

As the trench was bottomed out longitudinal sticks were laid down at about 2-foot centres, and on these a course of 2-inch plank laid crosswise and driven between the sheeting. Strips were in some places spiked to the sheeting above the flooring to hold the latter down. The longitudinals varied from 3x6-inch under the small sewers to 6x12-inch under the largest.

As soon as the toe of the sheeting was thus secured the lowest line of bracing was removed and the rubble masonry shown in the several sections in Fig. 2 started. A 12-inch drain-pipe was laid, as shown, and carried to the pump-well. Experience showed that it was better to place the drain in this position than under the grillage, as it was much less liable to stoppage. It was impracticable, however, to run the water more than 500 feet; after which the pump had to be moved forward to a new well. This necessitated laying the longitudinals and planking in water. To drive the spikes fastening the planking to the longitudinals a short tube was provided just large enough for the head of the spike to pass through, with a solid iron follower to transmit the blow of the maul to the spike. This was both simple and effective.

The 12-inch drain-pipe was used to within about 1,800 feet of the pumping-station; but here a peculiar quicksand, called by the workmen "bull's liver" (a mixture of quicksand and clay), was met, when, owing to the frequent stoppage, a 12-inch square box below the grillage was substituted. The foundation planks were cut short so as to leave this uncovered; and it was kept uncovered for a long distance until the side walls and inverts were nearly in. If this became filled up it could be shoveled out, and when covered and the invert completed the quicksand was excluded. This worked well, but was only practicable under the larger sections. (The section will be shown under the twin deposit sewers.) By these methods the masonry of the sewer proper could be laid above water and made tight so as to prevent the intrusion of the ground-water, which was vitally essential to the success of the scheme. The surface at the pumping-station was 4 feet above high water, and it was necessary to go to a depth of 26 feet for the sub-foundation. In doing this the entire area was excavated to a depth of 12 feet, with slopes of ¼ to 1 beyond the exterior lines of the walls. Then trenches, 12 feet wide, were begun and sheathing used for the remaining portion of the depth, the walls being about 9 feet on the bottom. At this point the bottom was good, and three courses of 6x12-inch timber were laid to obtain a foundation. After the walls were erected the centre core was taken out.

(TO BE CONTINUED.)

THE INCLINED RAILROAD UP LOOKOUT MOUNTAIN.

WHILE Major W. R. King, of the U. S. Engineers, was stationed at Chattanooga, he conceived the idea of a park on Lookout Mountain, to which access should be obtained by a railroad. He elaborated the scheme, and associated with himself several other gentlemen, and the road was formally opened on the 19th of March.

The incline is 4,300 feet long, rising in that distance about 1,200 feet. The grade varies from 1 in 3 to 1 in 6, the average being 1 in 3½. The track is narrow gauge (width not given), and consists of 25-pound steel rails laid on cedar ties, and secured by heavy lag-screws, and is well ballasted with stone. There are too heavy curves in the line, but 2,500 feet being straight. There are three rails in the track, thus making a double-track road. At the place where the up and down cars pass a fourth rail becomes necessary, so as to make two independent tracks, on which the cars move alternately up and down. The passing points are operated, however, without movable switches.

The propulsion is by cable operated from the foot of the incline. The cable is of special steel, is one inch in diameter, with an estimated breaking strength of 50 tons, and a maximum strain of 5 tons. The speed of ascent is about seven miles per hour.

The cars are fitted with a shoe-brake, designed by Major King, operating on the principle so much used in mountainous regions for braking wagons. The brakes are always "on," unless held "off" by the conductor. There is also a system of electric signaling.

At the top of the incline a narrow-gauge line, 1¼ miles long, operated by a saddle-tank locomotive weighing 11 tons, takes the visitors to Sunset Rock in nine minutes. The total cost of the line was about $150,000.

CONTRACTING ENGINEERING AND PLANT.

THE SUBURBAN RAPID TRANSIT COMPANY,
CHIEF ENGINEER'S OFFICE,
40 and 42 WALL STREET, NEW YORK, May 2, 1887.

SIR: The traveling crane illustrated in your issue of April 30, 1887, was designed by Mr. A. F. Brown, the General Manager of the Keystone Bridge Company, of Pittsburg, Pa., the contractors for the construction of the Third Avenue Line of the Suburban Rapid Transit Company, in the Twenty-third Ward of New York City.

The crane is operated very successfully by Mr. J. Buchan, the Keystone Bridge Company's Superintendent of Construction. So far as the Suburban Rapid Transit Company is concerned, the work is under the immediate supervision of Mr. F. D. Fisher, C. E., the resident engineer. Your obedient servant,

J. J. R. CROES, Ch. Eng., S. R. T. Co.

[We regret that the connection of these gentlemen with this work was not ascertained by our representative who prepared the article, and gladly publish this acknowledgment.—ED.]

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

SANITARY REGISTRATION OF BUILDINGS.

THE following bill to provide for the sanitary registration of buildings, which has been prepared by Mr. Lacaita, Dr. Farquharson, Sir Guyer Hunter, Dr. Cameron, and Sir Henry Roscoe, is now under consideration by the British Parliament:

Be it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

1. *Extent of Act.*—The act shall extend to the city of London, and to all parishes and places mentioned in Schedules A, B, C, to the Metropolis Management Act, 1885, and to the extended area as defined by the amending acts.

2. *Commencement of Act.*—This act, except in any cases where it is otherwise expressly provided, shall come into operation on the first day of January, one thousand eight hundred and eighty-eight.

3. *Authority for Execution of Act.*—The provisions of this act shall be enforced and regulated by a governing authority, hereinafter to be called the Sanitary Board, and which shall consist of twelve members, who shall be selected from the Sanitary Institute of Great Britain, the Royal Institute of British Architects, and the Association of Municipal and Sanitary Engineers and Surveyors, and whose duty shall be to define the duties of the sanitary surveyors and inspectors, and to form a court of appeal between the said sanitary surveyors and the public, and further to examine and appoint such persons, and in such a manner as they may think fit, and all candidates presenting themselves for the purpose of performing the duties of sanitary surveyor, and to grant certificates of competency; and no person who has not already filled the office of sanitary surveyor, or who has not obtained a certificate of competency from the said Sanitary Board, shall be qualified for election to the office of sanitary surveyor under this act.

The Sanitary Board shall also approve and license all sanitary apparatus, appliances, and fittings to be used in carrying out the provisions of this act.

The Sanitary Board shall have full power and authority over the local board engineers and surveyors, so far as relates to the drainage of houses, and further, where the sewers are inadequate or improperly constructed or ventilated, shall have power to call upon the local board to remedy same within a given time.

All matters relating to the sanitation of houses shall be under the control and direction of the Sanitary Board, subject only to the right of appeal to the Local Government Board.

The Sanitary Board shall receive monthly reports from every sanitary surveyor, giving full particulars of all work executed in his district.

4. *Sanitary Surveyor.*—"Sanitary surveyor" shall include any person duly qualified, by examination or otherwise, to perform the duties defined in this act.

Sanitary Inspectors.—The present "sanitary inspectors" shall be under the control of the sanitary surveyors as assistants.

House.—"House" shall mean and include schools, factories, and other buildings in which persons reside or are employed at any time.

Old Buildings.—"Old buildings" shall mean and include all buildings erected previous to the passing of this act.

New Buildings.—"New buildings" shall mean and include all buildings commenced after the passing of this act, or the conversion into a dwelling-house of any building not originally constructed for occupation, or the conversion into more than one dwelling-house of a building constructed as one dwelling-house only shall be considered the erection of a new building.

Whenever any old building has been taken down to an extent exceeding one-half of such building, such half to be measured in cubic feet, the rebuilding thereof shall be deemed a new building.

Where the interior of a building is burnt out and the walls left standing, the reinstatement thereof shall be deemed the erection of a new building.

Owner.—"Owner" shall mean and include all persons having an interest in the property, either present or in reversion, but shall not include occupiers holding a three years' agreement, or yearly tenants.

Sewer.—"Sewer" shall mean and include the main conduit for carrying off the drainage of houses, forming part of a system under a local authority.

Drain.—"Drain" shall mean and include any drain of and used for the drainage of one building only or premises within the same curtilage, and made for the purpose of communicating with a sewer.

Disconnection.—"Disconnection" shall mean that the connection of any drain with a sewer or any waste-pipe with a drain shall be broken by water contained in an approved trap and by ventilation.

Ventilation.—"Ventilation of drains" shall mean the provision of inlets for fresh air at point of disconnection and outlet for vitiated air at highest part of drain.

Cesspool.—"Cesspool" shall mean and include any receptacle for the storage or retention of sewage and waste water flowing from house.

Dust-bin.—"Dust-bin" shall mean any receptacle for the storage of house refuse.

Sanitary Appliances.—"Sanitary appliances" shall mean and include any cisterns, water-closets, syphon-traps, gullies, lead or any other metal pipes or traps, valves, and all dust-bins or receptacles, or any apparatus or thing used in connection with sanitary work, approved by the Sanitary Board.

Any apparatus not passed and licensed by the Sanitary Board shall not be permitted to be used.

5. *Division of Districts.*—For the purpose of this act the Metropolis shall be divided into seventy districts, each district to be under the control of a sanitary surveyor.

6. *New Buildings.*—After the passing of this act no new buildings shall be commenced until complete plans and sections (in duplicate) of the drainage have been deposited by the owner with the sanitary surveyor of the district for at least seven days.

No sanitary work shall be commenced until the plans have been approved by him.

If the plans are not in accordance with the provisions of this bill, notice shall be given by the sanitary surveyor to amend same.

Should the owner proceed with the work before permission is obtained, and after notice shall have been given to him in writing to discontinue the work, the sanitary surveyor shall have power to stop such work until amended plans have been approved, and to enforce penalties for non-compliance with the provisions of this bill.

No drainage work of any building shall be covered up until examined, tested, and passed by the sanitary surveyor. Should such drainage be covered up the sanitary surveyor shall have power to order the same to be uncovered at expense of owner on serving notice, and in default of compliance with notice to enforce penalties.

The sanitary surveyor or his deputy shall have power at any time to inspect works during progress of same.

No building shall be occupied or let for occupation until the whole of the sanitary appliances, fittings, and drainage works shall have been tested and approved, such being shown by sanitary surveyor's certificate.

The sanitary surveyor shall make inspection within seven days after receiving notice in writing that such building is finished and fit for occupation.

7. *Old Buildings.*—After the passing of this act it shall be lawful for the sanitary surveyor and assistants to enter upon and inspect and test all sanitary appliances, fittings, and drains upon leaving notice in writing upon the premises of their intention to make such inspection after seven days from the date thereof; such inspection to be made between the hours of 11 A. M. and 4 P. M.

Should the house be found in a sanitary condition the sanitary surveyor will certify the same, if desired, on payment of a fee of twenty-one shillings.

Should the house be found in an insanitary condition, the sanitary surveyor shall serve notice in writing upon the occupier, pointing out the defects, and requiring same to be amended, in accordance with the requirements of this act, within a period of three months.

In special cases the Sanitary Board shall have power to extend the time within which the work shall be done on formal application being made to them.

The provisions for the deposit of plans, execution of works, and granting certificates, and penalties for non-compliance with the provisions of this act for new buildings shall apply to old buildings.

After the passing of this act the deposited plans of buildings, and copy of the certificate, shall be accessible to the public at the office of the sanitary surveyor of the district on payment of a fee of one shilling. Copies of the plans and certificates may be obtained by the owner or occupier on payment of....fees, to be fixed by the Sanitary Board; and further, after the passing of this act, no house shall be let without the previous production of a sanitary certificate certifying that at that time the house is in a sanitary condition, such certificate to be valid for a period of six years only.

After the sanitary surveyor shall have given his certificate no alteration, variation, or addition to the drainage or sanitary work shall be made without having obtained the approval of the sanitary surveyor.

When the name of the owner cannot be ascertained, notices served on the occupier shall be deemed sufficient notice to the owner under this act.

8. The following provisions shall be observed in carrying out the work under this act:

All drains shall consist of good sound socketed pipes formed of glazed stoneware or of other approved materials.

The joint made between any two pipes in a drain shall be water-tight, and of such a character as to resist a pressure of not less than a four feet head of water from the highest point of the said drain.

The fall to a drain, where possible, shall not be less than one in thirty, and, where not so, a system of automatic flushing shall be provided.

Where the drainage is carried under a building, the drains shall be completely embedded in and covered with good and solid concrete at least six inches all around the pipe.

The several drains of a building shall not be constructed so as to form in such drains any right-angled junction; and every drain shall join another drain obliquely in the direction of the flow of such drain.

All drains shall be laid in straight lines from point to point, and inspection chambers provided at each change of direction of line of pipe.

All drains, where passing under walls, shall have a relieving arch turned over same.

9. *Disconnection from Sewer.*—The disconnection of house-drain from sewer shall consist of a syphon trapping, with or without a chamber of such a character as to afford easy inspection and cleaning, and shall be provided with an inlet for fresh air on the house side, which shall be equal to the sectional area of outlet ventilating-pipe, and in no case less than six inches.

10. *Ventilation of Drains.*—The outlet ventilator, which may be the soil-pipe if at highest part of drain, shall be by a vertical pipe or shaft fixed at the highest point of drain and carried up in a perfectly straight line its full diameter, free from bends or angles, except where unavoidable, and not to be in any case less than the sectional area of a pipe or shaft of the diameter of three inches, and taken up above roof of house clear of all windows and chimneys.

Every soil-pipe not at the highest point of drain shall be carried up above roof of house to the diameter and position before described.

In no case shall rain-water pipes be used as soil or ventilating pipes.

11. *Disconnection from House-drains.*—All pipes other than the soil-pipes shall be disconnected from house-drains and made to discharge over traps.

All waste-pipes shall have in their course an approved trap, of the same diameter as the pipes to which they are fixed, to prevent the same becoming an air-inlet, and all overflow-pipes shall be provided with an approved flap.

No sanitary appliance or fitting shall be used in any building unless the pattern has been approved by the Sanitary Board.

Particulars of all sanitary appliances and fittings will be issued to the public by the Sanitary Board.

12. *Water-supply and Cisterns.*—Where a constant supply exists, provision shall be made that the house supply shall be drawn off direct from the main for drinking purposes.

Where the water-supply is intermittent, provision shall be made for a drinking-water cistern, and covers to exclude all objectionable matter provided.

The wastes and overflows of all cisterns shall be made to discharge into the open air.

All cisterns to be easy of access for inspection and cleaning.

13. *Dust-bins.*—Dust-bins shall be limited to the smallest capacity in proportion to size of house, and not contain more than a week's refuse.

All receptacles for dust, ashes, rubbish, and dry refuse shall be constructed of non-absorbent material.

14. *Old Buildings.*—All existing cesspools shall be destroyed, and all materials accruing therefrom, and all contaminated earth and filth, shall be entirely removed, and the space so created shall be filled up with approved materials, and the foregoing shall apply to all disused sewers or drains running under buildings intended for occupation.

All pan-closets, containers, lead D-traps, and bell-traps shall be removed, and their reuse strictly prohibited, and all hopper closets, other than the pattern approved by the Sanitary Board.

All new sanitary work in old buildings shall be in accordance with the provisions of work in new buildings.

The cost of carrying out the work in the case of old buildings shall be borne by the owners, having regard to their respective interest in the house in possession, reversionary or otherwise.

In the event of dispute arising as to the apportionment of the cost of the works, each party shall appoint a sanitary surveyor, who shall agree upon an umpire. Should they be unable to agree upon an umpire he shall be appointed by the Sanitary Board.

Any disputes which may arise as to the necessity of all or any of the works required to be done by this bill between the owners and sanitary surveyor, the question or questions shall be referred to the Sanitary Board with a right of appeal to the Local Government Board.

The fees payable by the owners to the sanitary surveyor in the case of new buildings shall be as provided for the payment to district surveyor under the Building Act, 1855.

In the case of old buildings to be in proportion to the work to be done, but in no case to exceed the above sum.

15. *Penalties.*—If occupier or owner refuses to admit sanitary surveyor and assistants to inspect premises after having received due notice, he shall be liable to a penalty of ten shillings per day until notice is complied with.

If owner or occupier fails to comply with notice to deposit plans, or in case of new building fails to give notice and deposit plans in duplicate and to execute work, he shall be liable to a penalty of twenty shillings per day for each and every day allowed to elapse after the expiration of such notice.

If any person executing the work permits drains to be covered up before they have been examined and tested by sanitary surveyor, such person shall be liable to a penalty of twenty shillings per day for each and every day such drains shall remain covered up after expiration of notice to uncover.

If the work is executed in an unsatisfactory manner, and the owner fails to amend same after having received due notice from sanitary surveyor, the owner shall be liable to a penalty of twenty shillings per day for each and every day after expiration of notice until such amendments are made.

If owner lets house without having obtained the sanitary surveyor's certificate of completion he shall be liable to a penalty of forty shillings per day for each and every day the house shall remain so occupied.

If after owner shall have received notice from sanitary surveyor to amend defects in any apparatus which is found by sanitary surveyor to be in an insanitary condition, the owner shall be liable to a penalty of ten shillings per day for each and every day he shall, after the expiration of such notice, permit the same to remain in an insanitary condition.

16. *Notices.*—Notice to owner that alterations have been made since granting certificate requiring him to reinstate or to amend as required by sanitary surveyor within seven days, failing which he shall be liable to a penalty of twenty shillings for each and every day he shall after the expiration of such notice permit the same to remain unaltered or amended.

Notice from owner about to commence new building (seven days) with duplicate plan on annexed sheets.

Notice to owner that such notice has not been given, and warning him of penalties.

Notice to owner (or occupier) of intention of sanitary surveyor and assistants to inspect old building to learn sanitary condition.

Notice to owner to amend sanitary fittings, appliances, etc.

Notice to owner to amend deposited plans.

Notice to sanitary surveyor from owner to inspect drains before covering up same.

Notice to owner that drains have been covered up before they have been examined and passed by sanitary surveyor and warning him of penalties.

Notice to owner to amend unsatisfactory work.

Notice to sanitary surveyor from owner to inspect premises on completion.

THE PLUMBING CATECHISM OF THE NEW YORK TRADE SCHOOLS.

No. XIV.

(Continued from page 576.)

NOTE.—The founder of the New York Trade Schools and the Instructor of the Plumbing Class will be pleased to have the criticism of the readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD on any of these answers, or suggestions in the shape of fuller replies, with a view of perfecting them all that may be possible. In writing refer to the number of the query.

TRAPPING OF FIXTURES.

22. If two or more urinals were placed in a row should each be trapped separately, or would one trap do for all?

Each urinal should be separately trapped.

23. Should overflow-pipes from fixtures have separate traps or be connected with waste-pipe above its trap?

These pipes should be connected with the trap of fixture below its water-line. No need of separate traps.

24. If an overflow-pipe were trapped and then connected with waste-pipe above its trap, would this be an extra precaution or would it be objectionable?

It is possible that the overflow would get air-bound and thus destroy its object.

25. Where should the trap of a wash basin be placed?

As close to basin as posssible.

26. What is the best form of a trap under a basin?

An S lead trap properly vented is an excellent form of trap. There are other traps, however, which have special advantages.

27. Should it be larger, smaller, or same size as waste-pipe.

It should be the same size.

28. If two or more wash-basins were placed in a row will one trap do for all?

Each basin should have a separate trap. The rules of the Health Board require every fixture to be separately trapped.

29. Where would you carry the overflow-pipes in this case?

As before mentioned, into the traps of each basin.

30. Is there any objection to using the water-closet trap as a trap for baths, basin or any other fixtures?

There is. It should never be done.

31. Why?

Because it is double trapping and causes trouble with the back-airing.

32. Where should the waste-pipes from fixtures go?

Direct to the soil-pipe or waste-pipe.

33. Has any other plan been suggested?

It has been suggested to discharge them into an open sink or gulley trap. This is an English custom.

34. Do the ventilating-pipes of the traps under fixtures ever fail to work, and, if so, why?

They sometimes choke up from grease or filth if care be not taken to remove watër of condensation.

35. What could be done to prevent this?

To insert back air-pipe at highest point of trap and to give them a proper fall to removed the condensed water.

36. Why is it unnecessary to trap the waste-pipe from a boiler?

Because it is closed by a stop-cock and should be connected on the inlet side of trap of sink.

37. Are water-closet traps usually made by the plumbers or bought from the dealers?

They are usually bought from dealers.

38. Should the waste-pipe under a safe be trapped?

No.

39. Where should waste-pipes from safes be carried?

To a sink in cellar, or discharge on the floor. But not in a soil or drain-pipe.

40. How can the cellar air be prevented from entering rooms through this pipe?

By means of a flap-valve or rubber ball.

41. Is there any particular objection to trapping the waste-pipe from a refrigerator safe?

No. Care should be taken, however, to keep it clean by flushing it frequently.

42. How should the outlet be arranged to prevent passage of air?

By a flap-valve.

(TO BE CONTINUED.)

HOW TO ESTIMATE WALL-SURFACE.

LINCOLN, NEB., April 17, 1887.

SIR: In your issue of March 26, page 430, I find the following: "If any one wishes to work out wall-surface we give the height of ceiling, etc." Please inform me through your journal how one may figure wall-surface with size of windows, height of ceiling, and cubical contents. Is plan No. 1 scaled? What are the walls?

Respectfully, J. W. PERCIVAL.

[The scale of inches which was attached to the plan referred to was accidentally "routed" or cut from the block in the process of making, and hence did not appear as in the drawing. The whole width of the house was 20 feet, however, and from this you can approximate other lengths and find the outside wall-surface for a given room. From the whole surface thus found subtract the windows and divide the remainder by 10, and you have the approximate value of the cooling power of the wall in square feet of glass. Add this to the window-surface and compare the total to the heating-surface used, and it will give you the ratio of heating to cooling surface.]

INSULATION OF STEAM-PIPES.

MINNEAPOLIS, MINN., April 26, 1887.

SIR: We often have the question of insulation of steam-pipes raised by insurance companies in one place and another, particularly by insurance agents in the smaller towns.

We will esteem it a great favor if you will give us an opinion upon the authority of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, which we could use for quieting parties in such cases. We use every known means of insulation according to the conditions of the building, not that we believe that fires were ever started from steam-pipes under respectably decent conditions, but for the purpose of satisfying those who are ignorant on the subject, and we would like to be able to refer to THE SANITARY ENGINEER AND CONSTRUCTION RECORD as authority for what is right whenever we find some one more arbitrary than circumstances will warrant.

Very truly yours, F. L. BROOKS.

[The requirement of the New York Board of Fire Underwriters is that all steam-pipe be kept one inch from wood-work, and the wood-work tinned.

In our issue of June 24, 1886, page 87, "Thermus" went very thoroughly into this subject, devoting very nearly a page to the question, with two diagrams, in reply to a communication from J. W. Hughes, of Montreal.

It should be borne in mind that there is much evidence to prove that fires do take place just in the neighborhood of steam-pipes, and though it may be only negative evidence—that is, no positive assurance by any one that the fire did start from the heat of the pipe alone—still pipes should be scrupulously protected from contact with wood by iron guards, which latter must not touch the wood, except at their ends.]

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

SYPHON OUTLET FOR A LOW SEWER DISTRICT, NORFOLK, VA.

OFFICE CITY ENGINEER, NORFOLK, VA., April 28, 1887.

DEAR SIR: In reply to the inquiry of Mr. W. H. Baldwin in your issue of the 16th inst., I will state that the sewage is lifted through the syphon sixteen feet from its intake end to its apex. This is not a high lift, as I have in operation here a 10-inch centrifugal pump of the Joseph E. Edward's "cataract pattern," which is lifting sewage, including slush, trash, sand, etc., twenty-two feet vertically from the bottom of the suction to the axis of the pump. This, I think, is about as long a suction as has ever been successfully attained with this class of pump.

Permit me to say that I am rather surprised that Colonel Waring should have assumed the whole credit for the syphon spoken of. It is due to him to say that it was his suggestion to Major Humphreys—who began the sewerage here as engineer in charge—that prompted its adoption by me; but when, on February 28, 1884, I wrote to him (Colonel Waring) for details and plans, his reply was: "I do not know that I sent any plans about the syphons to Major Humphreys. I may have told him of them, or I may have written with a rough sketch. I can hardly stop now to have special drawings made." He did not "stop" to have any drawings made whatsoever, nor was there any planning or designing ever done by any one beside myself. The very drawings published in your issue of the 9th inst. are copies of those sent by me to Colonel Waring in August, 1886, at his special request, and I do not believe he could have described the work here without them, except in a general manner. Colonel Waring was the consulting engineer on his system of sewerage here, and courtesy naturally prompted me to submit my ideas to him before acting. His valuable advice is hereby gratefully acknowledged, although all of his suggestions were not carried out; but as the building and planning of the syphon were mine, and I had the responsibility to bear, I think it only justice to myself to make the foregoing statement.

Very truly yours, W. T. BROOKE, C. E.

REGARDING THE STUDY OF ARCHITECTURE.

CORNELL UNIVERSITY, April 26, 1887.

SIR: Being much interested in the subject of architectural education, I have read with great pleasure your leading article in the current issue of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, for the two points just now most easily lost sight of are, the length of time required to obtain a sound, professional training, and the fact that an engineering education is apt to be rather a hindrance than a help. I write, however, not to give unnecessary commendation, but to suggest that the latter point especially is one that needs more detailed discussion. I would, therefore, like to ask that an expression of opinion might be had through your columns upon the following fundamental question: "Would not *thorough* training in (1) geometry and conic sections, (2) algebra, and (3) trigonometry give the architectural student all the purely mathematical knowledge that is necessary?" If the gentlemen who have so kindly contributed to the discussion of your former question could be induced to give some expression of opinion upon this, it would be of material assistance to those of us who are concerned with the preliminary education of architectural students, and would also, I venture to think, be not uninteresting to the profession at large, who are more or less concerned with the efficiency of the coming generation of assistants. C. FRANCIS OSBORNE.

[We shall be glad to publish the views of our readers on the points here raised.—ED.]

USE OF PAPER BETWEEN CONCRETE JOINTS.

DES MOINES IA., April 28, 1887.

SIR: Will you through your valuable paper, or otherwise, let me know the earliest use of paper for forming joints in concrete or how I can find it, and oblige yours,

NATHAN W. SMITH.

[Referred to our readers.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
April 30......... ..	26 17	20.39	22.48	29.42	27.34	25.62	30 94

E. G. LOVE, Ph.D., *Gas Examiner.*

THE Mobile, Ala., City Council has made a contract with the Progress Electric-Light Company to light the city for $14,500 annually.

HARRISBURG, PA., has contracted with the Excelsior Electric Company to furnish 120 lamps of 2,000 candle-power each, at $116.50 per lamp per year.

THE gas companies of Chicago have consolidated into one company, known as the Gas Trust, with a nominal capital of $25,000,000.

HOBOKEN, N. J., has made a contract with the Hudson County Gas-Light Company to furnish gas to the city at $1 per 1,000 cubic feet, and $2 per 1,000 cubic feet to consumers while naphtha is not more than 5¼ cents per gallon and anthracite coal not more than $4 per ton. If the price of naphtha and coal rises, the company may increase its charges proportionally.

THE Gas Referees of London have issued their "Instructions" for the summer of 1887. There will be thirteen places for testing the gas of the Gas-Light and Coke Company, two for the Commercial Company, and four for the South Metropolitan Company. The gas must be free from sulphureted hydrogen, and must not contain more than 17 grains of sulphur nor 4 grains of ammonia per 100 cubic feet.

WHATEVER may be the future of the Welsbach incandescent gas-burner, the company which controls it is doing a good business at present in disposing of the patents.

THE Pintsch system of lighting by oil-gas has been introduced in one of the large omnibuses in London, and is proving very satisfactory.

MR. J. WYBAUW, Municipal Engineer of Brussels, in a letter to the *Journal of Gas-Lighting*, replies to the objections raised by Mr. F. D. Marshall against the double-index meter. Among other things he states that there are "at present in Brussels upwards of 3,200 double-index meters at work in a manner that leaves absolutely nothing to be desired." He aims to increase the use of gas for heating as well as for cooking purposes, and expects that the use of a cheap gas during the day will lead to a greatly increased consumption at the higher night rate for purposes other than illumination.

HALIFAX, N. S., will be lighted with electricity by the system of the American Electric Construction Company. The plant will be owned by the Halifax Gas-Light Company.

THE DISINFECTION OF RAGS PASSED ON IN COURT.

WE notice editorially the suit brought by Lockwood & McClintock, importers of rags, against E. B. Bartlett & Co. and Dr. William M. Smith, Health Officer of this port, to secure damages for the unlawful detention of rags while they were subjected to disinfection by a process controlled by E. B. Bartlett & Co. Dr. Smith was charged with corruptly conspiring to compel the rags to be disinfected. We quote from his testimony:

"My attention was first drawn to the danger from rags by the cholera in Egypt in 1883; I detained some cargoes, which afterward went forward to New Haven under the supervision of the health authorities at that port; there has always been danger from rags of small-pox and cholera and all the contagious diseases to which the human being is subject; many of the best sanitary and medical authorities so considered in 1885; my sources of information were the various medical publications, reports of health congresses and conferences, etc.; I knew of cases of small-pox in Massachusetts paper mills in 1872 and 1873; also knew of small-pox in paper mills at Aberdeen and other points; I was at the Fifth Avenue conference of health authorities; I knew the resolutions adopted there; rags which were accompanied by certificates that they had been disinfected abroad were not subjected to disinfection here; I accepted all of the four processes required by the Treasury Department; I have never expressed an opinion to anybody that disinfection was not necessary; never held such an opinion; my apprehension of cholera was so great that I solicited the health officers and sanitarians to attend the Fifth Avenue conference; I adopted the action of that conference in its entirety.

"A strange young man called on me twice during the latter part of 1884 to get me to witness a test; he said it would be for my interest, but I told him I knew my own business better than any one else, and he could take that message to those who sent him; I had never seen the strange young man before; a few days subsequently I met S. Webber Parker as I came off the Staten Island boat; he solicited my attention to some experiments for disinfecting rags in the bale; he set the day; it must have been in November, 1884; I witnessed a disinfecting test in Centre Street in company with Drs. Edson and Hamilton; one screw only was inserted into the bale of rags; the highest degree of heat shown was 196°; I recommended three screws as producing a higher degree of heat and the machine was changed accordingly; the Government ordered me to select the plant for the disinfecting machine, and I consulted with Dr. Raymond, of Brooklyn, as to the advisability of selecting the Baltic Stores; I asked Dr. Billings, of the United States Army, to superintend the final test, but he declined in favor of Dr. Sternberg, who, he said, had made a more

careful study of the scientific principles involved; I had a predilection for the sulphur process of disinfection before I became aware of the superheated steam method; I never sought, either directly or indirectly, to aid in any monopoly of rag-disinfection at this port, and I deny the various charges of interest in the disinfecting business.

"Prior to the middle of June, 1885, I supposed the question of rag importation and disinfection was in the hands of the Government, and I exercised no authority until urged to do so by the Custom-House authorities; I never gave any orders for the disinfection of rags on the 'Vigilant' and 'Battaglia'; the permit to the 'Vigilant' to pass Quarantine was issued by the Deputy Health Officer of the Port; it was given under a general order to facilitate the unloading of merchandise, excepting McClintock & Lockwood's Japan consignment of rags; I told Messrs. McClintock and Meyer that disinfection was a matter wholly in the hands of the Government, and that the Quarantine officials had peremptory orders about imported rags; my whole line of action during 1885 was in harmony with the policy of my predecessors, Drs. Carnegie and Vanderpoel."

On cross-examination, Dr. Smith said:

"I do not remember that Silas B. Dutcher told me about McClintock & Lockwood's consignment; while the ships 'Vigilant' and 'Battaglia' lay in the harbor Mr. Dutcher visited Quarantine once a week; I regard Mr. Dutcher as one of my most esteemed friends; Mr. Dutcher was appointed Superintendent of Public Works in January, and I was appointed in March; I had no recollection of talking with Dutcher about rags; I do not know who the young man was who called upon me and asked me to examine his disinfecting machine; I went to Centre Street at the invitation of S. Webber Parker; the machine tested in Centre Street in December was the same that was perfected and tested for the Government in Brooklyn on the following January.

"I had never heard of a disinfecting machine for rags in the bale before this one was brought to my attention; I have used sulphur to fumigate the holds of ships, but this invention, it was represented, controlled the fumes; I do not remember seeing Bartlett at the Centre Street test; I did not consider the experiment satisfactory, and I recommended certain improvements to make the machine efficient; my impressions as to the test were given to Surgeon-General Hamilton on the spot and to no one else, and a month later were incorporated in a report to him; in the interim I had entirely forgotten the disinfecting machine; I received a letter from the department in Washington in which specific mention is made of Bartlett & Co.; I did not remember this letter when I answered before in regard to the application of Bartlett & Co.; on receipt of that letter I examined the water-front in Brooklyn for a place to locate the plant, and with Dr. Raymond's aid I decided on the Baltic Stores as a fit and proper place; I was friendly, but not intimate, with Bartlett; I went to the warehouse on the strength of the letter of December 18 to select a place for disinfecting the rags, and I thought that the Government had decided on the Bartlett machine; although the original experiment was defective, in my judgment, I thought the machine had been improved; I agreed with Dr. Raymond not to approve of the process until its success as a disinfector had been fully demonstrated before a competent biologist.

I attended the test of the disinfecting-machine at the instigation of S. Webber Parker, one of the owners of the patent, and I paid Dr. Sternberg's expenses, $30, as he attended at my request; I had no interest in the machine, the test, as far as I was concerned, being in the interest of the health authorities and the public; I did not know that Bartlett was interested; I regarded Dr. Sternberg's report as sufficient evidence of the process, but I nevertheless in April solicited another conference; I think I remember that Dr. Raymond said the rags were perfectly safe, and that it would be running no risk to break the bales of rags after they had passed Quarantine; I do not remember that Dr. Raymond testified that the rags were perfectly safe, and that there was no necessity for causing them to be disinfected; I received a Treasury Department circular in December, 1884, containing regulations suggested by the national conference, which I regarded as ample if carried out to the letter; my object of calling the April conference was to get an expression of the health authorities on the incubating period of cholera; resolutions were adopted and sent to the Treasury Department; the conference did not discuss the machine, but discussed the process and recommended it; my knowledge that contagious diseases prevailed in Japan in 1884 and 1885 came from the consolidated reports by the National Board of Health.

"I could not swear that there was a single case of cholera or small-pox on or about the time the rags were shipped; I do not know on what coast of Japan Hiogo, from which port the rags were shipped, is situated; in general I should have considered it my duty as health officer to make myself acquainted with the sanitary condition of the shipping ports, but I based my negligence in this instance on the belief that the rags were gathered from a large area of country, and this impression obtained from Dr. Sternberg's report; I did not approve of the regulations of the Treasury Department, which exempted rags shipped prior to 1885; I considered all imported rags to be dangerous until subjected to the disinfecting process; I was two or three days writing a letter concerning the 'Vigilant's' cargo.

"My recollections in regard to interviews with the plaintiffs and Mr. Dutcher are not clear; I know very little about W. Scott Smith, secretary of the Paper-Stock Disinfecting Company, except that he was a Washington newspaper man; I told him at the office of the Board of Health to make an affidavit that the rags in dispute had not been shipped before January 1, 1885, and ought to be disinfected; I knew that the Brooklyn health authorities would not allow the landing of rags unless their healthy condition were certified to, and they were given a certificate that the 'Vigilant' did not come from a fever or plague-stricken district; when I wrote to the collector of the port, advising the disinfection of the rags, I knew that there was no other place than the Baltic Stores where the rags could be sent to be operated upon; prior to June, 1885, I did not take any active measures as a health officer to regulate the importation of rags.

"I did not take any steps to inform myself as an official what would be the cost of disinfecting rags; I heard that merchants complained that they were obliged to pay $5 per ton to the Paper-Stock Disinfecting Company; I obtained considerable moral support from the conference of my professional brethren at the Fifth Avenue Hotel, and the action taken gave me a keener appreciation of my responsibilities as health officer; I have done some fumigating of ships and received pay therefor, but I never applied to the State for an appropriation to pay for any such operation."

REPORT OF THE WATER BOARD OF NEW BEDFORD, MASS., FOR 1886.

THIS report shows the total net cost of the works up to the present time as being $1,259,402.21. The total population is 34,500, of which 28,420 were supplied 104 gallons each, or 86 gallons per inhabitant and 569 per tap. There are 45 meters on domestic service and 37 on manufacturing service-pipes, two-tenths per cent. of the consumption having been metered by the former and 9¾ per cent. by the latter. The cost of pumping per million gallons 1 foot high was 61.9 cents, and per million gallons, about 128 feet average height, $79.15.

The receipts from water rents were $43,530.43, and the cost of management and repairs $36,314.89. The construction account for the year was $41,810. The bonded debt is $720,000, with an average interest of 5.83 per cent. There are 50 miles of pipe from 4-inch to 30-inch in use, and 1⅛ miles of pipe less than 4-inch, also 388 fire-hydrants. There are three pumps in use, entitled respectively the McAlpine, Worthington, and High-Duty Worthington, and the water raised 100 feet per pound of coal by each, as the result of a year's work for the first two and six months for the last, was 630,495, and 815 gallons respectively. By discarding the delivery valve of the McAlpine engine, and making the pumps double-acting by adding plungers 20 inches in diameter just above the plunger valve, thus transferring half the work to the down stroke of the pump, the speed, which was 14 revolutions per minute, has been raised to 18, and with much less jar, and its pumping has been increased 20 per cent. The slip of the pump was 2.66 per cent. The record of the McAlpine pump is that made after the completion of alterations.

The high-duty engine, completed in June last, has a high-pressure cylinder 18 inches in diameter, 36-inch low-pressure cylinder, 24-inch plungers, and 26-inch stroke, with an independent condenser, having jacketed steam-cylinders, 6-inch stroke and 8½ inches in diameter. The suction-pipe is 24 inches and the discharge the same, forcing through a 30-inch force-main 1,879 feet long. There are two upright Corliss boilers, 13 feet 7 inches high, 64 inches in diameter, each with 128 tubes, 2 inches in diameter and 10 feet long. Grate surface, 37 square feet; heating surface, 1,190 square feet. The result of a 24-hour duty test was 6,233,511 gallons pumped in 24 hours, with an average piston speed of 94 feet per minute. This was 19 per cent. in excess of contract. The duty during a 12-hour trial was 102,108,759 foot-pounds, or 2 per cent. in excess of contract. The duty during a 6-day test was 79,238,160 foot-pounds. Mr. Robert C. P. Coggeshall is Superintendent of the works.

THE Boston Society of Architects issues in a neat pamphlet the Constitution and By-Laws, with list of members, etc., for 1887. The society was organized in 1867, and now has a membership of more than 100. The society is the director of the examinations for the Rotch Traveling Scholarship, which was founded by the children of the late Benjamin S. Rotch, of Boston, so carrying out their father's intention to establish such a scholarship, during his lifetime. By the terms of this scholarship the successful candidate in each yearly examination receives $1,000 annually for two years to be expended in foreign travel and study. The holder of the scholarship is required to prepare a report upon his return to be presented to the Boston Society of Architects at their first meeting in October, following his return. The first scholarship was awarded in 1884. The pamphlet notices the Portfolio Club fund, applied to the publication of sketches, and contains the schedule of professional practice and charges, as approved by the Boston Society of Architects, and also the "Schedule of Charges and Professional Practice of Architects," endorsed by the American Institute of Architects. The officers for 1887 are: President, Edward C. Cabot; Vice-President, Robert S. Peabody; Treasurer, William G. Preston; Secretary, Edmund M. Wheelwright.

A PUBLIC health conference will be held at Louisville, Ky., May 24 and 25, under the auspices of the State Board of Health. Among the subjects to be discussed are: Sanitary defects in the location of Louisville, and how they may best be remedied; typhoid fever in Louisville; water-supply; personal and domestic sanitation; model health system for cities; health legislation in Louisville; economic features of health work; school hygiene; the best method of teaching hygiene in schools; management of the preventable diseases; importance of private funerals after contagious diseases; house-plumbing; health features in architecture; relation of the clergy to health work; adulterations of foods; health leagues. Dr. J. M. Clemens is chairman of the Committee of Arrangements.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE spring meeting will be held at Washington, D. C., beginning May 31 and ending June 3. The headquarters and the meetings will be at Willard's Hotel. The sessions will be so arranged as to give the members time to visit buildings and sights of interest. A reception will be held on June 1, at the residence of Hon. Josiah Dent, and the next day there will be an excursion to Mount Vernon. On the last day visits to the Navy Yard, Patent Office, and Naval Observatory are provided for. Papers on the following subjects will be read:

By Samuel Webber, "Tests of the Camparative Value of Different Kinds of Belting"; L. H. Rutherford, "Should a Piston Packing Ring be of the Same Thickness at Every Point"; John T. Hawkins, "The Education of Intuition in Machine Designing"; R. H. Thurston, "Systematic Testing of Turbines in the United States"; Charles E. Emery, "Notes for Discussion on the Limit of Steam-Pressure in Marine Engines"; Charles E. Emery, "Notes for Discussion on Cylinder Condensation"; Albert Stearns, "A Method of Evaporation by Means of Exhausted Steam"; Henry R. Towne, "Methods of Determining Cost and Distribution of Power and Heat"; William Kent, "A Problem in Profit Sharing"; Charles E. Emery, "Comparative Value of Steam and Hot Water for Transmitting Heat and Power;" Thomas S. Crane, "Direct-Acting Steam-Veneering Cutter"; H. A. Ramsay, "What are the Needs of Our Navy;" R. H. Thurston, "Notes on Helical Seams in Boiler-Making;" Joseph Morgan, Jr., "National Defense and the Mechanical Problems which it Involves;" George H. Babcock, "A New Method of Making Tubes from Solid Bars."

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE annual convention will be held at the Hotel Kaaterskill, in the Catskill Mountains, beginning about July 2. Arrangements will be made for a trip up the Hudson River, with a stop at West Point and at Poughkeepsie to visit the works for the bridge now building at the latter point. During the convention visits will be made to the Cement Rock Mines and Cement Works of the Rondout Valley. The committee request that members will be prepared to discuss or present papers on the following subjects:

"The Inspection and Maintenance of Railway Structures."

"The Disposal of Sewage."

"Recent Practice in Cable Railway Propulsion."

Papers should reach the house of the society in this city by May 31.

AT the meeting held on the 4th inst. the following gentlemen were elected to membership:

Members.—Richard Milford Berrian, Chief Engineer Atlantic Coast, St. John and Indian River Railway, New York City; John Sterling Deans, Assistant in Estimating and Designing Department, the Phœnix Bridge Company, Phœnixville, Pa.; John Addison Fulton, Resident Engineer, Chicago, Sante Fe and California Railway, Kansas City Mo.; Wilbur Francis Goodrich, Resident Engineer Toledo, St. Louis, and Kansas City Railroad, Kokomo,

Ind.; John Rogers Hudson, now engaged in general engineering, Pomona, Cal.; Frank Adolph Leers, Engineer Passaic Rolling Mills and Bridge Works, Paterson, N. J.; Jo: George Macklin, Chief Engineer Midland Division Grand Trunk Railway, Peterborough, Can.; David Lowber Smith, Deputy Commissioner Department of Public Works, New York City.

Associate.—Robert James Pratt, Electrician and Manager Electric Manufacturing Co., Troy, N. Y.

Juniors.—Edgar Bonaparte Gosling, Department of Docks, New York City; Alfred Milton Mosscrop, Instructor Department of Civil Engineering, Cornell University, Ithaca, N. Y.; Edward Walter Rathbun, Assistant Engineer Napanee, Tamworth, and Quebec Railway, Napanee, Can.; William Plumb Williams, Assistant Engineer Electrical Subway Commission, New York City.

An abstract of a paper by Professor George F. Swain, Assoc. Am. Soc. C. E., "On the Calculation of the Stresses in Bridges for the Actual Concentrated Loads," was read.

Also a paper by J. Albert Monroe, Mem. Am. Soc. C. E., on "Novel Method of Removing Air from a Vertical Bend in a Suction-Pipe."

The method described in the latter paper was the application of a steam-injector to the top of the bend by a direct pipe from the boiler in such a manner as to exhaust the air. By reversing the direction of the steam it could also be used in cold weather to melt any ice forming in the bend.

A discussion took place also on certain questions connected with the testing of cements and the removal or prevention of the efflorescence on walls. As to the latter, Mr. Worthen mentioned the application on brick walls of the soap and alum solutions. Two or three applications of each externally caused no discoloration, and absolutely prevented all efflorescence.

A curious case of cement-testing was mentioned by Secretary Bogart in which a cement showed greater strength at all the ages of mixture thus far tested when mixed one of cement to one of sand than when mixed neat.

NEW YORK ARCHITECTURAL LEAGUE.

A REGULAR meeting of the New York Architectural League was held Monday evening, May 2, at No. 6 West Twenty-eighth Street. Considerable routine business was transacted and the constitution, as reported at the April meeting, was adopted. Under its provision a President, Vice-President, and an Executive Committee were elected as follows: President, John Du Fais; Vice-President, Bruce Price; Executive Committee, Charles I. Berg, Frederick Crowninshield, Edward H. Clark, John Gellatly, Frederick A. Wright, John Beverly Robinson, John Reilley, A. B. Turnure, William C. Hazlett.

THE SECOND ANNUAL MEETING OF THE ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.

THE pamphlet just published gives a full account of the January meeting. The officers for the present year are: Prof. I. O. Baker, President; M. J. Foster, Vice-President; Prof. A. N. Talbot, Executive Secretary; Mr. S. A. Bullard, Recording Secretary; Mr. George P. Ela, Treasurer; with a list of fifty-one active and three honorary members.

The pamphlet contains a very well considered address by the president, covering a summary of engineering progress for the year; a paper by Samuel S. Greeley, of Chicago, on the "License System for Surveyors," and a bill prepared by the society, embodying its views on the subject; a paper comparing the combined and separate systems of drainage for cities, by S. A. Bullard, of Springfield; on "Topographical Surveys and Records for Drainage Purposes," by C. G. Elliott, of Tonica; on "Hints on Field Work in Drainage Engineering," by A. H. Bell, of Bloomington; on "Apportionment of the Cost of Drainage Improvements," by D. J. Stanford, of Chatsworth; on "Exterior Boundary of Townships," by F. Hodgman, of Climax; on "Perpetuation of Corners," by J. S. Bart, of Henry; on "Importance of Accurate Measurement," by D. L. Bancher, of Lincoln; on "Pavements for Small Cities," by George F. Wightman, of Peoria; on "Mode of Establishing Corners on Township and Range Lines for Fractional Sections," by Z. A. Zenos, of Springfield; on "Reservoirs for Railroads, Farm Use, etc.," by S. F. Balcolun, of Champaign; on "Oil and Natural-Gas in Illinois," by Professor Theodore B. Comstock, University of Illinois; and on "Railway Trestles," by Edwin A. Hill, of Indianapolis. There are also reports on several subjects by standing committees.

MEMPHIS HEALTH REPORT.

THE precise population of Memphis is unknown, and, therefore, precise death-rates cannot be given, but in the eighth annual report of the Board of Health Dr. Thornton takes the figures computed from a city directory, which gives as the total death-rate 22.86 per 1,000, being for the whites 16.81 and for the colored 33.89. At all events, we can say that Memphis was healthier in 1886 than it was in 1885, the deaths in 1885 having numbered 1,484 and in 1886, 1,425. An intercepting sewer has been completed by which all the sewage on both sides of the celebrated Bayou Gayoso, south of Monroe Street, is carried directly to the river, thus relieving the 15-inch mains of the general system. Six hundred and ninety-two water-closets were connected during the year with the sewers, and a little over three miles of subsoil drains were laid. Dr. Thornton again urges the necessity for the improvement of the Bayou Gayoso and its main branches. The statement of work done by the sanitary police shows that it has been busy: 30,908 houses were inspected and 23,086 loads of garbage removed; 1,801 dead dogs were also disposed of, indicating a heavy death-rate among those animals.

Judging from this report Memphis will present a good record to the American Public Health Association when it meets there in November next.

NOTES FROM PHILADELPHIA.

SINCE 1855 Philadelphia has had only three building inspectors. As the city covers 125 square miles, and last year's building operations are estimated to amount to $30,000,000, this number of inspectors is altogether inadequate. Accordingly a bill has been introduced in the State Legislature to increase their number to five.

The Director of Public Works last week brought several builders into court for violating the ordinance relating to the placing of building materials in the streets while building operations are going on. The ordinance requires gutters to be left clear, but this provision is disregarded by builders who often cover them with building materials. One of the builders was fined $5 and costs, and the cases of the others continued.

The Director of Public Works, according to general opinion, has already effected a great improvement in the cleanliness of the streets.

PERSONAL.

BARTOW W. VAN VOORHIS, President of the Manhattan Iron-Works, died at the Murray Hill Hotel, in this city, recently, in the 66th year of his age.

MR. HENRY MENDENHALL, President of the Diamond State Iron Company, of Wilmington, Del., died in that city, April 28, in the 50th year of his age.

MR. JOHN A. KLUNK has been elected engineer of the Columbus, O., Water-Works.

DR. O. W. WIGHT, who has been Health Officer of Detroit, Mich., for several years, sails May 18 for Europe.

DR. S. P. DUFFIELD, of Dearborn, Mich., has been elected Health Officer of Detroit, to succeed Dr. Wight.

C. WYLLYS BETTS, of the firm of Betts, Atterbury & Betts, patent lawyers, of this city, died April 27.

MR. GEORGE O. MANCHESTER, of Boston, has been elected President of the California Central Railroad Company.

EDWARD GRIDLEY, of the firm of Edward Gridley & Son, died last week at Wassaic, N. Y. He was an active member of Society of Mining Engineers.

MR. C. P. FOOTE has been reappointed Commissioner of Public Works of Milwaukee, Wis., for the term of three years.

MR. GEORGE A. KIMBALL, who retires from the office of City Engineer of Somerville, Mass., after twelve years' service, was a few days ago presented by his friends in the city departments with a gold watch and chain as a testimonial of their appreciation.

MR. THOMAS H. MCAVOY, lately Superintendent of the Bureau of Repairs and Supplies of the Department of Public Works in this city, died May 2. After the War Mr. McAvoy practiced for a time as an architect. He was appointed to the Department of Public Works in 1882.

MR. JOHN LYMAN FAXON, architect, of Boston, has just returned from a tour through Italy and France, which he made for health and the study of Romanesque and Byzantine architecture.

I. M. DE VARONA, C. E., of the Department of City Works, Brooklyn, has been employed to prepare plans for additional water-supply for Albany, N. Y.

BUILDING INTELLIGENCE.

(Continued from page 592.)

BROOKLYN—(Continued.)

S s Lynch st, 134 e Harrison av, 4 fr stores and dwells; total cost, $21,200; o, Beck & Stoltz; a, John Platte.

S e cor 3d av and Baltic st, 4 br tens and stores; total cost, $48,000; o, E R Herbert; a, F L Hines.

N s Kosciusko st, 225 e Lewis av, 8 br dwells; total cost, $36,800; o, John McDicken; a, Ernst Dennis.

N s Fulton st, 23 w N Y av, br dwell and store; cost, $10,000; o, Mrs Julius Diefendorf; a, George P Chappell.

S w side Broadway, 60 e Hart st, br dwell and store; cost, $8,000; o, G J Mahler; a, John Herr.

S s Van Buren st, 150 e Sumner av; 10 br dwells; total cost, $56,000; o, David L Beasly; a, J D Reynolds.

S s 52d st, 220 w 3d av, 12 fr dwells; total cost, $24,000; o and a, Geo Brandt.

W s Cambridge place, 200 ft n of Gates, 3 b s dwells; cost, $20,250 all; o, Parker Ford; a, Mercein Thomas.

N s Fulton st, 353 ft w of Tompkins av, br store and dwell; cost, $10,000; o, F. W. Caruthers; a, I D Reynolds.

N e cor Myrtle ave and North Elliott place; 2 br stores and tens; cost, $24,000 all; o, John N. Eitel; a, Carl F Eisenach.

N e cor Broadway and Linden st, 2 br stores and dwells; cost, $35,000; o, M E Meeker; a, S P Irving.

ALTERATIONS, BROOKLYN.

W s Ferris st, between Dikerman and Partition, brick machine shop; cost, $10,500; o, Lidgerwood Mfg. Co; a, J V Beekman.

N e cor Manhattan and Greenpoint aves, br station house; cost, $8,000; o City of Brooklyn; a, not selected.

MISCELLANEOUS.

ANN ARBOR, MICH.—Messrs. Donaldson & Meier, architects, of Detroit, have completed plans for a high school building to cost $24,000.

AKRON, O.—The medical fraternity are making preparations to build a new city hospital.

ALTON, ILL.—In progress, St. Joseph's Hospital.

ALBANY, N. Y.—The contract for erecting the Beth Emith Temple, on Lancaster and Swan Streets, have been given to William Turner, mason, and Alexander Simpson, carpenter. The cost will be about $120,000.

ALBANY, N. Y.—Swan, cor Lancaster, Jewish Synagogue; cost, $120,000. a, A Fleisshman; b, Turner & Simpson.

State st, br dwell; cost, $10,000; o, Jos Russell; a, R W Gibson; b, Jas W Eaton.

BAR HARBOR, ME.—O. M. Shaw & Son will make extensive alterations to the West End Hotel.

BATAVIA, N. Y.—Plans for the library building, given to the village by Mrs. Dean Richmond, have been drawn. The cost will be $25,000.

BROOKINGS, DAK.—Joralemon & Ferrin, of Minneapolis, have made the plans for the new agricultural college.

BUFFALO, N. Y.—Washington, nr Mohawk Street Theatre; cost, $80,000; o, H Weilland One; a, Aug Esenwein; b, Charles Berrick.

Bryant, cor Howard av, fr residence; cost, $8,000; o, Charles Richardson; a, W W Cailin; b, Hoeffler Bros.

BROOKLYN, N. Y.—Architect Charles Haight has prepared plans for an extension to Adelphi Academy, located on the corner of Lafayette av and Exchange Place. It will be of brick, 5 stories high, with a frontage on Clifton Place of 150 feet, and on St. James Place of 64 feet. New class and lecture rooms will be located in it. Two other extensions are to be made, which will be used as a gymnasium and a boiler room. Total cost $150,000.

BALTIMORE, MD.—President st, near Pratt, 3-story br warehouse; o, James Bates.

208 Pratt st, near Concord, 5-story brick bldgs; o, Charles Hollander.

Fourteen buildings costing less than $7,000 each.

BALTIMORE, MD.—The Union Square Methodist Church will tear down the present building and erect a new one.

BEAR MOUNTAIN (near Hot Springs), ARK.—Fr hotel; cost, $8,000; o, W. H. Fergerson; a, Razee & Thompson.

BRIDGEPORT, CONN.—Eaton, Cole & Burnham will build a new factory on Main Street.

BIG RAPIDS, MICH.—The Grand Rapids and Indiana Railroad Company is building a large depot.

COUNCIL BLUFFS, IOWA.—In progress, Catholic cathedral, cost $50,000.

CLEVELAND, O.—Messrs. Cudell & Richardson, architects, have prepared plans for an 8-story building for U S Senator Henry B Payne, to cost $200,000. It will be built of brownstone, be fire-proof, and have two elevators.

(Continued on page 609.)

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

TRADE CATALOGUES.

THE Endolithic Marble Company, 123 Fifth Avenue, New York, have sent us their illustrated catalogue, entitled "Endolithic Marbles: their History and Use."

THE Weir & Nixon Steam and Warm-Air Heating Company, 1410 N. Sixth Street, Philadelphia, have issued a catalogue illustrating and describing the Nixon patent heating apparatus.

CONTRACTING INTELLIGENCE

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.*

For works for which proposals are requested, see also the "Proposal Column," pages 595-596.

WATER, SEWERAGE, ETC.

DETROIT, MICH.—City Engineer Ludden is making plans for sewers in the outskirts of the city.

The Park Board has decided to purchase or hire a steam-pump for pumping out the marshes at Belle Isle.

MARSHALL, MICH.—The Common Council is considering the purchase of the Perrin water-power for $30,000.

CORUNNA, MICH.—This town has decided to have water-works.

SEWARD, NEB., will have water-works to cost $20,000. The plans and specifications are by Mr. A. A. Richardson, of Lincoln, Neb.

ST. PAUL, NEB.—Bids were opened May 5 for building water-works to cost $20,000. A. A. Richardson, of Lincoln, Neb., has prepared the plans.

MCPHERSON, KAN.—Plans and specifications for water-works here are being prepared by Mr. A. A. Richardson, of Lincoln, Neb. They will cost about $60,000.

WATER COMPANY.—Just organized is the Farmington, Me., Water Company, which recently obtained a charter.

ASBURY PARK, N. J.—The pumping machinery called for in the proposals to be opened May 14 is: One compound, non-condensing, duplex, steam pumping-engine, capable of delivering 500,000 gallons daily against a pressure of 150 pounds per square inch. The boiler is already in place. Bids will state the price for the whole machinery and appurtenances, including the foundation and masonry.

DUNDAS, ONT.—The Water-Works Committee of the Town Council has the provision of a water-supply in consideration.

WASHINGTON, D. C.—The plans of Captain Thomas W. Symons for extensions of water-mains have been adopted by the District Commissioners and work will be begun soon. The District Commissioners have approved the expenditure of $50,000 for sewers, and contracts will be made at once.

JAMESTOWN, N. Y.—A new water company is being organized here by New York and Philadelphia projectors. A proposition has been made to furnish hydrants to the city at $40 per year each.

SEWERS.—See our Proposal Column for a notice in regard to sewers in San Diego, Cal.

LITTLE ROCK, ARK.—The water-works are nearly completed. They are on the gravity system, and comprise a receiving reservoir 300 feet above the mean water-mark of the Arkansas River, a distributing reservoir, 2 Blake pumping-engines with a capacity of 50,000 gallons daily, pumping through 3,000 feet of 16-inch pipe to an elevation of 265 feet. The receiving reservoir is 290'x190'x24', the distributing reservoir is 260'x190x18'. The cost was about $200,000. The builder and owner is Zebulon Ward, Sr.

ST. PAUL.—Incorporated are the following: The Park Point Gas and Water Company of Park Point, St. Louis County; incorporators, R. W. Petre, Rufus P. Edson, Bernard Silberstein, Henry H. Bell, Wallace Warner, Duluth; Roswell H. Palmer, Park Point; R. H. Hartley, John B. Atwater, Minneapolis; Stephen Van Wyck, St. Paul. The Crookston Street-Railway Company; incorporators, C. E. Sawyer, Andrew D. Stephens, E. D. Childs, John Crumb, Halyor Steenerson, all of Crookston.

BAR HARBOR, ME.—Water-works supply houses will do well to address Charles T. How, President of the Eden Water Company, as that company will probably soon begin to build works.

DECATUR, ALA.—The President of the water company just organized to build works here, reported in our last issue, is A. F. Murray. The Secretary is L. J. Ogden.

RAPID CITY, DAK.—A great flume will be built here requiring 3,000,000 feet of lumber.

WALTHAM, MASS.—The Sewer and Drain Committee have just reported, urgently recommending that work be begun at once on the system of sewers designed by Mr. E. W. Bowditch, C. E., of Boston.

INCORPORATED is the Corn Creek Irrigating Company of Salt Lake City to complete the Corn Creek dam and ditches. Ezra W. Penny is President.

INCORPORATED is the Low Line Canal Company, with capital stock, $600,000. Directors: J. M. Gilbert, E. E. Soule, G. G. Gilbert, M. M. Munsell, all of Spearville, Ford County, Kan., and A. T. Soule, of Rochester, N. Y. This corporation is formed for the purpose of constructing ditches to convey water for irrigating lands, for power for running mills, for supplying towns, cities, etc. Spearville, Kan., and Rochester, N. Y., are the principal business headquarters.

MILFORD, MASS.—Milford voted almost unanimously at a special meeting, May 2, to repeal the town committee's report to purchase the Milford water-works. It also voted unanimously to accept the sewerage committee's report embodying a complete system for using the existing sewers and constructing others, costing finally about $300,000. The plan, made by Ernest Bowditch, of Boston, was adopted.

PUMPING-ENGINES.—Albany, N. Y., will purchase a pumping-engine of about 15,000,000 gallons capacity daily. Other improvements will be made. The bill, just signed by Governor Hill, limits the total cost to $1,200,000. Mr. H. E. Sickels, of the Special Water Commission, says action will soon be taken to begin the work.

I. M. de Varona, C.E., of the Department of City Works, Brooklyn, has been selected by the Water Commission to make plans for the work.

PHILADELPHIA.—The Newark Filtering Company has made propositions to the Water Committee of Councils for erecting a filter-plant. One proposal was to erect a plant, complete, with a capacity of 1,000,000 gallons per day for $15,000, or one of forty times that capacity for the sum of $600,000. The matter was referred.

OTTUMWA, IOWA., water-works and water-power has been sold to the Iowa Water Company, which will make efforts to induce manufacturers to use the water-power.

STEVENS' POINT, WIS.—The Water Company is just incorporated with a capital of $175,000, to build water-works here. W. H. Fritchman, of New York City, and Henry Curran and Dr. Lloyd Jones, of Stevens' Point, are incorporators.

WASHINGTON, PA.—Water-works, to cost $100,000, will be built here.

ROCK FALLS, IND.—The Sterling Water Company will furnish a water-supply.

GREELEY, COL.—Water-works are projected here. Mayor George H. West may be addressed.

LINCOLN, NEB., has received a report from C. C. Burr in favor of the gravity system of water-supply.

GREAT BARRINGTON, MASS.—A system of sewerage will be built here; cost, $6,000.

BATH-ON-HUDSON, N. Y.—The board of trustees has authorized President Peterson to make a contract with the Greenbush Water-Works Company, to erect and supply a system of 35 hydrants at a rental of $1,300 a year.

PORTLAND, MICH., wants a water-supply from an artesian well.

WATER-WORKS.—Undertakings to put in water-works are in progess in the following towns: Washington, Geo.; Gainesville, Geo.; Carlinville, Ill.; Worcester, O.; Tecumseh, Neb.; Red Cloud, Neb.; Fort Benton, Mont. ($40,000); Drummondsville, Province of Quebec; South Evanston, Ill.

MONTICELLO, ARK., contemplates building water-works.

NASHVILLE, TENN.—The City Council has selected Kirkpatricks' Hill as the site of the new reservoir. City Engineer J. A. Jewett estimates the cost at $434,442; of this $63,849 is for pipes, gates, etc.

FARGO, DAK.—There is an agitation here to extend the water-supply system.

CONCORD, N. H.—The Water Commissioners have decided to extend the water system to Penacook, as previously reported. The cost of the work is put at $43,000. W. M. Chase is Clerk of the Water Board.

CHATTANOOGA, TENN.—The Missouri Ridge Water Company, recently reported, will lay mains and erect stand-pipes.

SANTA FE, N. M.—The New Mexico Land and Irrigation Company has been organized to build an irrigation canal 47 miles long in Taos County. William P. Allen, of Manitou, and Colonel J. M. Piper, of Dallas, Tex., are interested.

TROY, N. Y.—The Water Commissioners have received from Engineer Baermann an estimate of the cost of a 10,000,000-gallon pumping-engine.

JANESVILLE, WIS.—The Board of Water Commissioners has directed the Secretary to advertise for proposals for constructing water-works plant. They will be received until May 23.

MARSHALL, MICH., is considering the purchase of the Perrin water-power, to apply it to manufacturing purposes.

PROPOSALS.

(Continued from page 596.)

REMOVAL of wreck, now lying in Bayou Teshe, near Chariton, La. Until May 31. Address Major W. H. Heuer, U. S. Engineers, New Orleans, La.

IRON bridge across the Dakota River at Yankton, Dak. Until May 18. The length of the bridge will be 150 feet, built of iron, with a roadway 14 feet clear, and the construction of the same to be finished on or before September 16, 1887. No plans have been prepared for the construction of the same, and bidders are therefore expected, and are requested, to make their selection of the same in bidding. A draft of plans and specification must accompany each bid. Christian Hage, County Auditor and Clerk, Yankton, Dak.

GRADING 10 to 30 miles of the Sheffield and Birmingham Railroad. Address P. Campbell, Superintendent, Sheffield, Ala.

BUILDING the State Normal School for colored persons, at Frankfort, Ky. Until May 10. Plans are by McDonald Brothers, architects, of Louisville. Address John O. Hodges, President of the Board of Trustees, Frankfort, Ky.

BERLIN, Ont., water-works construction and maintenance. Until June 3. Address Israel Bowman, Town Clerk.

PROPOSALS are invited until May 23, 1887 for the erection of the West Tennessee Hospital for the Insane. They must be addressed to Austin Miller, Chairman, Bolivar, Tenn. Plans and specifications can be seen at the office of McDonald Bros., Louisville, Ky., and at the office of Austin Miller. The work contemplated embraces a large amount of bricklaying, carpenters' work, plastering, plumbing, tin and galvanized iron-work and painting, and will also embrace a complete system of water-works and steam-heating,

PROPOSALS.

for which separate contracts will be made. The Asylum Commissioners have contracted for, and have now on hand, a large stock of brick, with every prospect of a supply as rapidly as may be demanded. The most of the foundations have already been put in, and work can be commenced immediately with a large force. For further information address McDonald Bros., Architects, Louisville, Ky., or Austin Miller, Chairman, Bolivar, Tenn. The right is reserved to reject any and all bids. McDonald Bros., Architects.

IRON floating-gate or caisson. Sealed proposals, addressed to the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., indorsed "Proposals for Floating Gate," will be received until May 25, for furnishing the necessary labor and material for the construction of an iron floating-gate, or caisson, for the dry dock at the Navy Yard, Boston, Mass. Plans of the floating-gate, or caisson, and all attachments pertaining thereto, can be seen, and copies of specifications and instruction to bidders obtained, by applying to the Bureau of Yards and Docks, Navy Department, the Civil Engineers' Office at the Navy Yard, Boston Mass., or at Navy Pay-Office, cor Broadway and Chambers Street, Stewart Building, New York City. D. B. Harmony, Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C.

IRON-WORK of Pipe Island Light-House. Until May 21. Address Major S. M. Marshfield, U. S. Engineers, 312 Woodward Avenue, Detroit, Mich.

CONSTRUCTION of lateral sewers in District No. 4, of Avondale, O. Until May 30. Address W. Ellwood Wynne, Corporation Clerk, Avondale, O.

DREDGING as below. Until May 11: Half-slip, west of Pier 19; Pier No. 44, west side; Pier No. 43, east side; bulkhead between Piers 43 and 44. Address the Department of Docks, Pier A, New York City.

PROPOSALS.

SEWER PIPE for San Diego, Cal. Until May 20. Quantities as follows: Minimum quantity required, interior diameter, 6-inch, 150,000 feet; 8-inch, 20,000; 10-inch, 4,800; 12-inch, 1,500; 15-inch, 3,000; 18-inch, 1,000; 24-inch, 6,750. Specials required not to exceed 10,000. Four-inch Y-branches for house connections on sewers of the different sizes above indicated. Also the following Y-branch connections of sewers: 6x6, 32; 8x6, 16; 8x8, 7; 10x6, 1; 10x8, 1; 12x6, 1; 12x8, 1; 12x12, 3; 18x6, 2; 18x10, 2; 24x6, 16. Also the following Y-branches for inspection pipes: 6x6, direct, 575; 6x6, reversed, 575; 8x8, direct, 70; 8x8, reversed, 70. All pipe to be thoroughly vitrified, either slip-glazed or salt-glazed, and must be sound, with a clear ring when struck. Defects of glazing on the outside need not reject, but inside glazing must be perfect. Pipe delivered in the city of San Diego and provisionally accepted by the Resident Engineer will be paid for at the rate of 75 per cent. of the contract price. Final payment of 25 per cent. will be made monthly on the engineer's estimate of the length of pipe actually laid in completed sewers. At such payment proper deduction will be made for rejected pipe on which the preliminary 75 per cent. shall have been paid. Twenty thousand feet of 6-inch pipe and 1,500 6x4-inch Y-branches, to be delivered as indicated by the Resident Engineer of the city of San Diego, within 15 days of the signing of the contract, the remainder to be furnished promptly as called for from time to time, and all within six months of the signing of the contract. All proposals offered shall be accompanied by a check payable to the order of the President of the Board of Trustees of said city, certified by a responsible bank, for an amount which shall not be less than 5 per cent. of the aggregate of the proposal, or by a bond for the said amount, with condition that bidder will carry out the terms of his bid, signed by the bidder and by two good sureties, who shall justify before an officer competent to administer oaths in double

PROPOSALS.

said amount over and above all statutory exemption. The Board of Trustees of said city reserves the right to reject any and all bids. M. D. Hamilton, President of the Board of Trustees of the city of San Diego, California.

CONSTRUCTION of bridges. Until May 11:

1. Stone bridge on Ridge Avenue, over the Wissahickon Creek, in the 21st Ward.
2. Wooden Bridge at Poplar Street, over the Philadelphia and Reading Railroad, on Pennsylvania Avenue.

Specifications and blank forms, upon which bids must be made, will be furnished upon application by the Chief, Bureau of Surveys.

Louis Wagner, Director, Department of Public Works, City Hall, Philadelphia.

ONE HUNDRED MILES, of railroad, grading, bridging, and fencing, in Western Nebraska, on the K. C. & O. Branch of the St. Jo & G. I. railroad, running west from Fairfield, Neb. Address D.D. Streeter, & Co., Fairfield, Neb., or Denver, Colo., 1653 Wazee st.

FURNISHING and laying iron water-pipe, also hose-nozzles, etc., for protection against fire. Until May 21 Address Lieutenant John Millis, U. S. Engineer, Third Light-House District, Tompkinsville N. Y.

CONSTRUCTING PARAPET WALL of the breakwater in Cleveland Harbor, O., 4,500 lineal feet. Until May 10. Address Mayor L. Cooper Overman, U. S. Engineers, Cleveland, O.

CHATTANOOGA, TENN.—The City Water-Company is asking for estimates for constructing two stand-pipes, and making other improvements, at the cost of $40,000.

ST. ELMO, TENN., will consider a proposition of the Mountain Spring Water Company to furnish a supply of water. Mr. John Rawlings is interested.

WACO, TEX.—The following bids for constructing water-works were received by Mayor E. A. Sturges April 23: Inman Bros., New York; Samuel R. Bullock & Co., New York. The contract was awarded to Inman Bros., under franchise of twenty years. Hydrant rental, 150 hydrants at $50; each additional, $50 each. Bond in sum of $20,000 to complete works in one year from date of signing contract from March, 1887.

WALLACE, KAN.—The Wallace Water-Works Company is incorporated. H. A. Clark, Thomas Madigan, Peter Robidoux, A. B. Montgomery, I. S. Teeters, and Charles Edwards, incorporators.

TOLEDO, O.—The Water-Works Committee will expend $12,000 in laying 12-inch mains to supply water to the East Side. Col. Lemert makes a proposition to the city to buy the works.

GAS, STEAM, BUILDINGS, ETC.

CLEVELAND, O.—The Board of Industry will expend $25,000 in sinking experimental gas-wells. Messrs. Axworthy, Lockwood, Edwards, Pelton, and Stafford are the committee to expend the money.

PARIS, ILL.—A company has been formed to sink natural-gas wells.

LEWISTON, ME., has a Committee of Council considering the utilizing of the water-power for electric-lighting.

PITTSBURG, PA.—The Baden Natural-Gas Company will soon begin to lay an 8-inch main from Freedom to Rochester, Pa.

DETROIT, MICH.—The city will receive bids for lighting until May 10.

Proposals are advertised for the construction of a Museum of Arts building. Address Collins B. Hubbard, Secretary, 48 Moffatt Block, Detroit, Mich.

The Brush Electric Company, of Cleveland, has received the contract at $6,040 for lighting the Casino and its approaches. There were seven other competitors.

MANSFIELD, O.—A gas-well will be sunk here to the depth of 3,000 feet.

ST. JOHNS, MICH.—Gas-works, to cost $25,000, will be built here this summer.

PORT HURON, MICH.—Thirty gas-wells will be sunk the coming summer.

GRAVESEND, L. I.—The Gravesend Gas-Light Company was incorporated May 2. Henry J. Hubbard and William C. Jones, of New York, and Frederick H. Smith, of Brooklyn, are incorporators.

NEW YORK CITY.—The bid of the United States Illuminating Company for electric-lamps in its districts has been accepted by the Gas Commissioners. Bids for electric-lights in other districts will be again opened May 16.

MILWAUKEE.—The Columbia Electric Gas-Light Company was incorporated April 25. P. L. Spooner, Jr., President. The headquarters will be in Madison. They will manufacture and sell a patented device for purifying gas and increasing the power of illumination.

RAILROADS, BRIDGES, CANALS.

RAILROADS IN NEW YORK.—We print below references to some of the projected lines of railroad in this State:

The West Shore is preparing to run a branch from its main line, connecting at Kingston, on the Hudson River, through to Richfield Springs.

About 300 citizens and capitalists met in Cooperstown recently to perfect arrangements for the new Cooperstown, Richfield Springs & Fort Plain Railroad, which will connect at the latter point with the New York Central and at the former with the Cooperstown and Susquehannah Valley Road. The project has Alfred Corning Clark's $33,000,000 behind it.

Another project is to build a road from Valatie to Kinderhook, via Niverville. The work of grading for this road will be commenced at once. The business men of Malone, in the northern part of the State, have also a scheme. The road will be built from Malone to Troy Pond, a distance of eighteen miles. At Troy Pond a junction will be made with the Chateaugay Railroad, running from Plattsburg to Loon Lake. A company is organizing with a capital of $75,000, of which $35,000 has already been subscribed.

MILWAUKEE.—The West Side Street Railway will extend its tracks west on State Street from 12th to the city limits; also, to locate a line from corner of State and Eleventh Streets east to Eighth Street, south to Cedar, east to Fifth, and connect on Fifth with present terminus at Exposition Building.

The Walnut Street line of the Milwaukee City Railway Company will be extended from Sixteenth Street to Twentieth.

BRIDGE.—The Pittsburg and Lake Erie Railroad has under consideration the bridging of the Mahoning River near Lowellville, O. Arrangements have been completed, and the proposed structure will be built this season. The point selected is a short distance west of the village of Lowellville, where the Pittsburg and Lake Erie tracks hug the river-bed closely. The bridge will be of iron, and the estimated cost is $30,000.

ALBANY, N. Y.—The Board of Contract and Apportionment orders proposals advertised for 11,094 square yards of granite paving.

JEFFERSONVILLE, KY.—A bridge will be built here. Hon. J. G. Howard is interested.

NORRISTOWN, PA.—The Commissioners of Montgomery County invite proposals for the mason-work of three and iron-work of two county bridges to be erected this season. These proposals or bids will be received up to 10 A. M. on Saturday, June 4, at the office of the Commissioners. The three county bridges are to be erected at the following places: One over the Swamp Creek, in the township of Frederick; one over Perkiomen Creek, at the borough of Greenlane, and the third over Frog Hollow Creek, in the township of Abington.

BENTON HARBOR, MICH.—Business men are making preparations to build a canal 51 feet wide and 7 feet deep, nine miles across the country, to tap Paw Paw Lake. It will cost $275,000.

BRIDGE.—Governor Hill has signed the Farrell bill, which provides for the appointment of a commission to consider the feasibility of constructing a bridge or tunnel over or under the East River between this city and Brooklyn, from the foot of Grand Street.

OTTAWA, CAN.—It is proposed to build a $250,000 bridge over the Rideau River, also over the Ottawa River, to celebrate the jubilee year. Mayor Stewart is in favor of it.

JOLIET, ILL.—A syndicate representing the Belt Line Railroad Company, including the Chicago, Milwaukee and St Paul, Chicago and North-western, and Chicago, Burlington and Quincy, has bought twenty-five acres in the north-eastern suburbs of Joliet. Transfer depots, elevators, stock-yards, and car-shops will be built. The Atchison, Topeka and Santa Fe and a local syndicate, of which it is said the Joliet Steel Company is a leading member, are the accredited projectors of the scheme.

RAILROAD.—Articles incorporating the Republican Valley and Wyoming Valley Railroad were filed with the Secretary of State, at Omaha, Neb., April 25. This, it is said, is to be a branch of the Chicago, Burlington and Quincy.

RAILROAD.—Work on the Perry County Railroad, running from Duncannon to New Bloomfield, Pa., a distance of eleven miles, will commence May 10. The contract for grading and bridging the railroad has been awarded to McGinnis & White, of Manheim, Lancaster County, Pa., for $32,199.90.

BRIDGE.—The City Council of Eau Claire, Wis., has awarded the contract for the Water Street bridge to H. E Horton, of Faribault, Minn., for $10,500. It will be 860 feet long.

BIDS OPENED.

BROOKLYN.—Bids have been received by the Board of Education for building a new school-house on Lafayette near Clason Avenue, and also for repairs to Public Schools No. 9 and No. 16.

The bids for the Lafayette Avenue School were as follows: Mason-work: John H. O'Rourke, $31,687; F. J. Kelly, $28,414; John McQuaid, $33,900; P. Carlin & Sons, $33,500; J. H. Stevenson & Sons, $29,338. Carpenter-work: T. F. O'Brien, $17,237; Morris & Selover, $17,587; M. C. Rush, $16,798; Martin & Lee, $16,460. Plumbing: James White, $3,398; William Martin, $3,450; John Seton, $3,176; John Davis, $3,425. Tin roofing: James Hurley, $1,466; James Keenan, $1,449. Iron stairs: Manly & Cooper Manufacturing Company, $3,484; Paulsen & Eger, $3,385.

The bids for an addition to Public Schoo No. 9 were the following: Mason and carpenter work and roofing: John O'Rourke, $28,675; F. J. Kelly, $35,500; P. F. O'Brien, $38,525; John McQuaid, $33,900; Martin & Lee, $37,857. Plumbing only: James Hurley, $1,190; James Keenan, $1,125. Iron stairs: Manly & Cooper Manufacturing Company, $3,438; Paulsen & Eger, $3,385.

Bids for an addition to Public School No. 16 were: Mason, carpenter work, and plumbing: John H. O'Rourke, $23,900; P. F. O'Brien, $26,275; John McQuaid, $25,814. Plumbing only: James Hurley, $1,290; James Keenan, $1,345. Iron stairs: Manly & Cooper Manufacturing Company, $3,757; Paulsen & Eger, $3,385. The contracts will be awarded to the lowest bidders.

ST. PAUL, MINN.—Bids for heating apparatus for certain school-houses have been received, as below, by the Board of Education:

NAME AND SYSTEM.		Madison School.	Jefferson School.	Lincoln School.
E. F. Osborne	Mould	$7,900 02	$8,196 28	$6,138 18
	Ellis gr'vity	8,623 86	9,001 90	6,784 47
Rogers & Davis	Mould	6,885 00	6,983 00	5,888 00
	Ellis gravity.	6,178 00	6,058 00	4,944 00
	Double com.	6,605 00	6,722 00	5,715 00
C. H. Parmelee	Mould.......	....	6,600 00	5,650 00
	Ellis gravity.	....	5,700 00	5,000 00
	Double com..	... .	6,000 00	5,380 00
Holland & Thompson.	Mould	5,226 00	5,145 00	3,531 00
	Inch valves.	1,292 00	1,555 00	910 00
	Ellis gr'vity	7,065 00	6,470 00	4,656 00
	Double com	600 00	600 00	600 00
Edw. Kelly.	Mould	8,596 00	8,971 00	6,962 00
	Ellis gravity..	7,820 00	7,941 00	6,100 00

BOSTON, MASS.—Proposals for boilers for the high-service pumping-station, Chestnut Hill Reservoir, were opened May 3, and taken under advisement. They were as follows: James Russell & Sons, $9,380; H. S. Robinson, $7,390; Whittier Machine Company, $6,656; George Miles, $5,928; Edward Kendall & Sons, $6,411. The bid of the Cunningham Iron-Works, $6,200, was rejected for an informality, being unaccompanied by the required check.

DETROIT, MICH.—The Detroit Pipe and Foundry Co. has received the contract for supplying the water-works with forty miles of iron pipe.

NORFOLK, VA.—The following bids for a compound non-condensing pumping engine of 2,000,000 gallons daily capacity and two steel boilers were received by the Board of Water Commissioners, March 28: Holly Manufacturing Co., Lockport, N. Y., $3,100 and $2,400; Godwyn & Co., Norfolk, Va., $4,500; Volker & Co., Buffalo, N. Y., $3,100; Deane Steam-Pump Co., Holyoke, Mass., $2,835; Atlanta Wind-Engine Co., Atlanta, Geo., $3,360; Davidson Steam-Pump Co., New York City, $5,450; Blake Manufacturing Co., New York City, $3,150; Knowles Pump Co., agent in Norfolk, $3,300; H. R. Worthington, New York City, $3,065 and $2,030. The contract was awarded to Deane Steam-Pump Co., Holyoke, Mass.

For boilers the bids were as follows: Thomas W. Godwyn & Co., Norfolk, for Lawson boiler, $498; for Bradford boiler, $851; Sterns Manufacturing Co., $452 and $818 respectively; Atlanta Wind-Engine Company, $472 and $745; Elizabeth Iron-Works, Norfolk, $496 and $757; E. W. Durall & Co., Norfolk, for both boilers, $1,816; Tanner & Delaney Engine Co., Richmond, Va., for both boilers, $1,190; Reeder & Co., for Lawson boiler, $745, for Bradford boiler, $1,160; Cecil P. Pool, Norfolk, Va., $600 and $1,100 respectively; Southwark Foundry and Machine Co., Philadelphia, $825 and $1,225; Hodge & Co., East Boston, $485 and $850; O. B. Goodwin, agent, Norfolk, $433 and $800. The contract was awarded to the Tanner & Delaney Engine Company.

WASHINGTON, D. C.—Schedule of bids opeded May 2, by the Engineer Commissioner, for building school-houses: F. Baldwin, house on North Capitol, between K and L Streets, $22,700; house on Fifth Street, between D and E Streets, $22,500; for both $45,200; C. Thomas, $22,400, $22,300, $44,700 respectively; D. A. Driscoll, $23,300; $22,975, $46,275 respectively; J. L. Parsons, $22,750, $22,650, $44,900 respectively; Halliday & Wilson, house on North Capitol, between K and L Streets, $23,097.

NEW YORK CITY.—Bid were opened at the Department of Public Works on Monday, May 2, for paving streets and laying sewers. The following were the lowest bidders: Section 1, Wm. A. Cummings, $9,052.60; Section 2, William J. Clark, $20,071.30; Section 3, P. H. Fitzgerald, $8,599.53; Section 4, William Kell, $13,009.08; Section 5, William Kell, $13,063.74; Section 6, J. B. Smith, $27,488.20; Section 7, sewer work, James Moore, $9,102.50; Section 11, imperfect; Section 12, sewer work, E. E. De Camp, $5,975.

NORFOLK, VA.—Abstract of bids for constructing sewers in Section A, opened April 30 by the Sewer and Drain Commissioners (W. T. Brooks, City Engineer, in charge of the works): H. R. Hill, Williamsport, Pa., 150 feet of 15-inch pipe and laying, $2.95 per foot; 725 feet of 12-inch pipe and laying, $2.70 per foot; 1,550 feet of 10-inch pipe and laying, $2; 3,600 feet of 8-inch pipe and laying, $1.80 and 98c. perfoot; 9,000 feet of 6-inch pipe and laying, 87c. per foot; 16,000 feet of 4-inch pipe and laying, 40 cents per foot; 600 feet of 13 inch cast-iron syphon-pipe, $3.67 per foot; 22 Field's automatic flush-tanks, $53 each; 15 manholes, $32 each. On 8-inch pipe this bid was $1.80 per foot for 725 feet, and 98c. per foot for 2,875 feet.

Joseph I. Lawton, Norfolk, Va., $2.95, $2.80, $2.40, $1.25, 90c., 35c., $5, $53, $54 respectively.

Daniel Molony, Norfolk, Va., $5.90, $570, $5, $2.80, $1.08, 20c., $5, $38, $25, respectively.

NEW HAVEN, CONN.—Bids for the almshouse at Springside Farm, to be built after plans by Allen & Tyler, have been received. We quote the principal ones:

Bates & Townsend, for masonry on main building, $139,285; for two wings extra, $25,560.

George A. Baldwin & Sons, for masonry on main building, $145,200; for two wings extra, $38,664.

J. N. Leonard & Co., for masonry on main building, $149,645; two wings extra, $38,564.

George N. Grant, for masonry on main building, $138,545; two wings extra, $38,340.

Tracy Brothers, Waterbury, for masonry and carpenter-work on main building, including the foundations, but not plumbing, $163,238.44; with the two wings, $208,901.44.

E. H. Sperry, masonry on main building, $143,465; two wings extra, $27,450.

John W. Gaffney, Waterbury, masonry on main building, $91,700; two wings, $29,700.

The New Haven Steam-Heating Company sent in a bid to furnish a low-pressure steam-heating apparatus for $18,250; for the two wings extra, $3,950; while H. B. Smith & Co. will put in heating and ventilating-apparatus in the main building for $16,650, and for the two wings extra, $4,075.

For the iron-work on the main building the Yale Safe and Iron Company ask $19,035.18 and $3,310.18 extra work for two wings.

ROCHESTER, MINN.—The contract for iron-work of the new jail has been let to J. H. Van Dorn, Cleveland, O., $7,250. Main building contract to Granville Woodworth, this city, $12,125.

ST. PAUL, MINN.—Bids for engine-houses at Merriam Park and Hamline have been opened as follows, the contract being awarded to Donahue;

Noble & Munn, at Merriam Park, $14,650; at Hamline, $14,430.

J. H. Donahue, $11,475, $11,300.

Rundle & King, $10,700, $10,000.

M. P. Ryan, $11,700, $11,775.

W. Erickson, $15,666, $15,666.

Charles E. Heath, $13,900, $13,620.

ALTOONA, PA.—Proposals for furnishing the Water Department with fourteen 4-inch and two 6-inch stop-valves were received from Messrs. Walter S. Payne & Co., Fostoria, O.; Mellert Foundry and Machine Company, (limited), Reading, Pa.; William T. Hiscox New York; Galvin Brass and Iron-Works, Detroit, Mich.; Peet Valve Company, Boston; Lehigh Valley Brass Works, Bethlehem, Pa.; Bailey, Farrell & Co., Pittsburg, and the Eddy Valve Company, Waterford, N. Y. The bid of Walter S. Payne & Co., of Fostoria, O., was accepted, the firm to furnish Eliot's patent gate valves at the following prices: Fourteen 4-inch at $8 each; two 6-inch at $13.75 each.

NEW ORLEANS, LA.—The Council is considering a bid from A. Rieling, presented by R. J. Conolly, contractor, for cleaning the drainage canals. It is estimated the cost will be at least $350,000. The necessary machinery has been purchased in Oswego, N. Y.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 24. — PUBLISHED EVERY SATURDAY.

NEW YORK, MAY 14, 1887.

LONDON, MAY 28, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. — IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. — IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

THE NEW YORK TENEMENT-HOUSE ACT OF 1887.

ELSEWHERE in this issue we devote space to publishing what is known as the new Tenement-House Act, to which we made a brief reference in our issue of April 2. It will be seen that the act is in the nature of a series of amendments to an existing act. It is yet too soon to judge of the practicability of enforcing the several provisions, though an examination of them indicates that in some particulars further amendments will be required before they can be adequately enforced.

Sections 658 and 659 are good, and are important steps forward, likewise Section 664. The requirement of Section 658, that the board shall make an inspection of all tenement-houses at least twice a year, will produce good results, providing the board is given power and funds to increase its corps of inspectors sufficiently to do the work. Otherwise it will probably be void, for while this law apparently increases the force, it is held to really diminish it, since under present statutes, including the law of two years ago relating to so-called "sanitary engineers," the board has thirty-five inspectors, while this act limits the number to twenty-five.

Section 585. The Commissioner of Public Works has more than enough to do now, more directly in his special line; he had better, therefore, not be included in this commission. What board is to collect statistics, and what statistics? If this special commission is intended, where is the appropriation to pay for it? The same query arises in the case of Section 588.

Section 649. Under this clause all hotels would be included.

Sections 649 and 657 are defective in not giving the sole authority to decide as to sufficiency, etc., to the Board of Health. In a dispute a jury must decide.

Section 659. Under this section it would seem that the board cannot act until the sanitary superintendent has certified, etc. It would have been better to say, "whenever the Board of Health shall be satisfied that any building," etc. We believe that our Health Board will do all they can, with the means allowed them, to carry out the intent of the act, and time will demonstrate its shortcomings, whether pointed out here or not. The law as it is will be found interesting and suggestive reading to authorities of other cities.

LIBRARY OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

SINCE the question of a Technical Library in this city and the needs of the library of the American Society of Civil Engineers has for some time been a subject under discussion by our engineering contemporaries, it may be well for the trustees of the American Society of Civil Engineers to consider the desirability of submitting to the members of the society a proposition that they shall contribute a certain sum per year to a special fund to be devoted to the employment of a competent person to arrange, catalogue, and index the books, reports, and journals which have already accumulated, and take proper care of those coming in the future.

The value of a library of this kind is in direct proportion to the ease with which the inquirer who comes to it can ascertain what it contains relating to the matter in which he is interested and the quickness with which he can get access to the books which he desires to see. It is because the library of the Society, through lack of funds, has not been properly cared for and catalogued that it remains comparatively inaccessible to members of the profession. So long as this condition remains the more books are added the worse the confusion will be.

What is needed now is a trained cataloguer, who will take account of stock, note just what periodicals are wanted to complete the files, secure copies of important reports as they are published, and prepare a card index by means of which any member of the society can ascertain at once the bibliography of the subject which interests him, abstracts of which may be sent to out-of-town members on request.

If the trustees decide it is best to move in the matter on the lines here indicated, stating definitely what is proposed and the amount of money required, we believe their appeal will meet with the needed response, since the members will then appreciate the immediate practical results to be attained.

THE USE OF STEEL RIVETS.

A correspondent, who is very competent to express an opinion, writes us on this important subject as follows:

"Mr. William Metcalf, in a recent discussion by the Western Society of Civil Engineers on the use of steel for structures, condemns in strong terms the use of steel rivets, giving as a reason that such in boilers at the Crescent Steel-Works have to a large degree failed—the "machined" head cracking off. (See report in technical journals.)

"This statement and conclusion, from one so well informed generally as to the proper uses of steel as a material by engineers, is likely to do harm, and I suggest that it be criticised on these grounds:

"*First*—The work of rivets in boilers and in structures is dissimilar; in the boiler, probably in a lap-joint, and subject to the varying temperatures, the rivet is strained lengthwise and consequently at the head; in structures, a rivet becomes a pin, which is subject chiefly to transverse and similar strains as such.

"*Second*—Experience elsewhere in the use of steel rivets does not sustain his judgment. Of the hundreds of thousands of steel rivets in the East River Bridge—suspended structure—driven at the rate of 3,000 or more per day for weeks, some by power, others by hand, all several years ago, when to get suitable material was much more difficult than now, so far as those charged with the care of the bridge know, *not one* has lost a head or proved imperfect. The thousands of steel rivets used later in subsequent works here are also in good condition.

"*Third*—If engineers are to decline to use a materia otherwise desirable because of difficulty in its use, greater than that attending the use of other and inferior material, progress in this direction is retarded and will ultimately cease. The fact that to-day cement for foundations may be readily procured of uniform and high quality and at reasonable rates, is largely due to the rigid inspection and high requirements of former years."

OUR BRITISH CORRESPONDENCE.

Test of Air in Schools at Edinburgh—Architects' Designs for Advertising Purposes—R. I. B. A. Conference—Elevated Railroads along the Liverpool Docks—The Metropolitan Sewage Question—The Smoke Nuisance.

LONDON, April 27, 1887.

UNDER the auspices of the Public Health Committee, a series of experiments are being carred on in Edinburgh with a view to obtaining data for testing the atmosphere in schools, theatres, and public places generally. The apparatus employed to indicate the presence of (1) carbonic-acid gas, (2) of germs, and (3) of organic matter, is as follows: (1) For carbonic acid, the air, from the various altitudes desired for testing, is pumped into bottles of a known capacity, iuto which a solution of baryta is afterwards introduced. The determined capacity of baryta for the absorption of carbonic acid permits of the calculation of the amount of carbonic-acid gas in the quantity of air sampled. (2) In testing for germs, a 2-inch glass tube, 2½ feet long, coated with gelatine, is used. A measured quantity of air is drawn through the tube, and any germs present deposit themselves on the gelatine. In the course of a few days these germs will be distinctly visible and their genera ascertainable. (3) In testing for organic matter the apparatus consists of a set of six bottles, with connections, and filled with distilled water. A measured quantity of air is drawn through the apparatus, through the medium of a reversed aspirator affixed at one end. The air is drawn through in minute quantities, to allow of thorough washing before it escapes at the extreme end, and the water is then subjected to analysis. Drs. Hunter Stewart and Cosmo Burton, in conjunction with Sir Douglas Maclagan, of the Edinburgh Health Laboratory, are conducting the experiments.

An enterprising London advertising agent, whose specialty is enameled iron, is asking for plans for a Jubilee Clock-Tower for Brighton, the total cost of which shall not exceed one thousand guineas. Certain structural parts are to be of enameled iron. The magnificent premium of 20 guineas ($100) is offered for the accepted plan, which, together with specifications, shall be the absolute property of the advertising agent in question. This gentleman has evidently a limited appreciation of the value of architects' work, and seeks a good advertisement for himself—CHEAP.

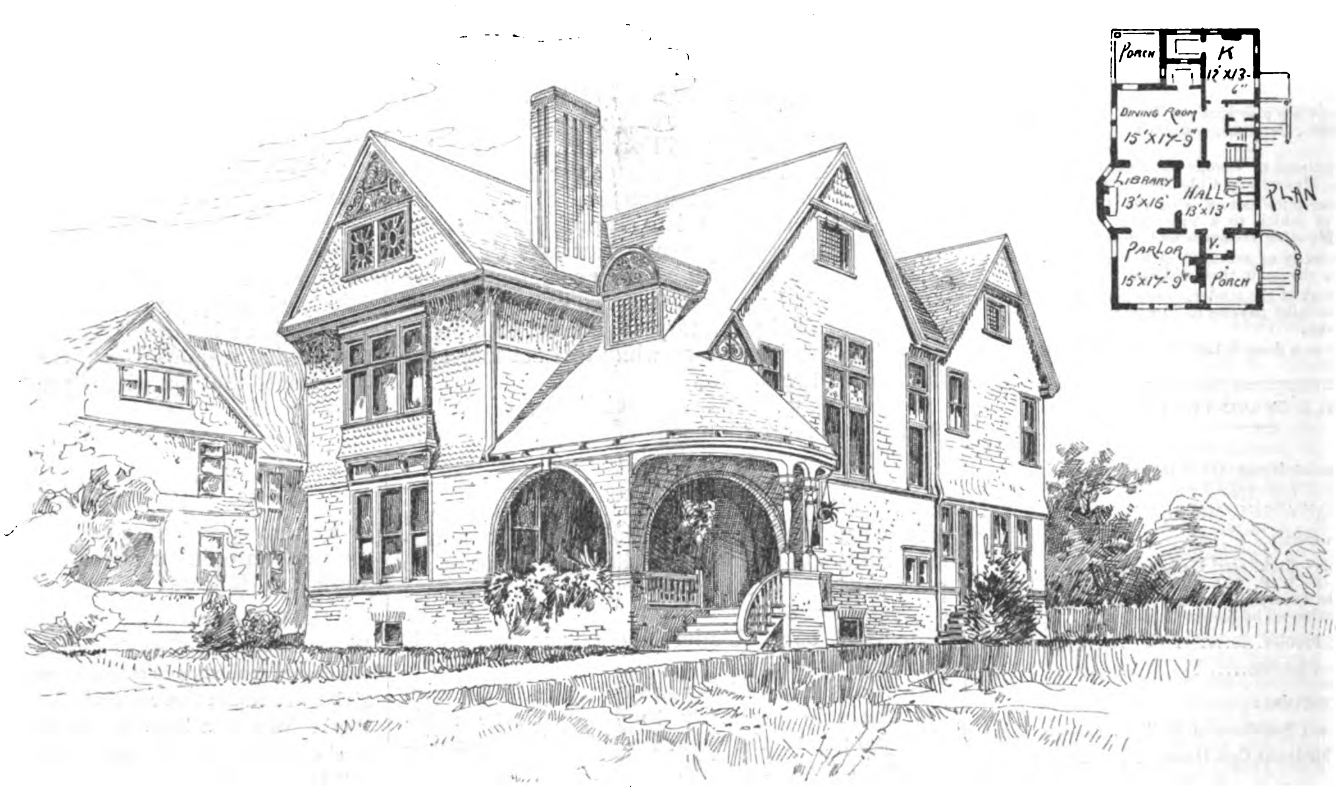
During the week commencing with May 2, a conference of architects promoted by the Royal Institute of British Architects is to be held. Papers will be read on "Architects and their Handicraft," "Architectural Education," "New Materials and Inventions," and "Registration of Architects," and there will be a discussion on the Report of the Special Committee of the Institute on "Architectural Federation." The proceedings will also embrace visits to notable buildings and works.

The Mersey Dock and Harbor Board has under consideration a scheme for an elevated railway to run along the line of docks in Liverpool. The project will cost about £650,000 ($3,120,000) and the distance is about 2½ miles. Under the existing system goods are transported in railway trucks drawn by horses, which travel on countersunk lines. The passenger traffic is by means of omnibuses, the wheels and axles of which are gauged to travel on the same line of metals as the trucks. If it is desired to pass a train of trucks, which, of course, is a matter of continual occurrence, the omnibus has to be pulled out of the metals and run around the trucks until it can strike the rails again.

The metropolitan sewage question becomes more serious and difficult to deal with every year. The public press has already fully criticised the experiment the Board of Works are about to make at a cost of about half a million, and there is now but little hope that this will prove a successful solution of the difficulty. The precipitation process by lime and sulphate of iron was applied to 9,000,000 gallons daily during last summer, the whole volume being treated with permanganate of soda before discharge, with a view of deodorization. The result was naturally discouraging, as during the cool weather the treatment was sufficient, but when the temperature rose, as a consequence, the river-water became foul and discolored and gave off a horrible stench. Dr. Collingridge believes that it is no exaggeration to say that the river was as bad as it has ever been, the nuisance being noticed higher up the river than usual (as far as Vauxhall).

Lord Stratheden has introduced a bill into the House of Lords, with the object of abating, or rather abolishing, the smoke nuisance. The desirability of such an end is admitted, but will certainly not be attained by extravagant proposals. One of the main clauses demands that every dwelling-house, as well as factory, should have fire-places and furnaces constructed on the smoke-consuming principle. This would embrace existing structures, and, were there any possibility of such a clause passing, would be good news to patentees. SAFETY VALVE.

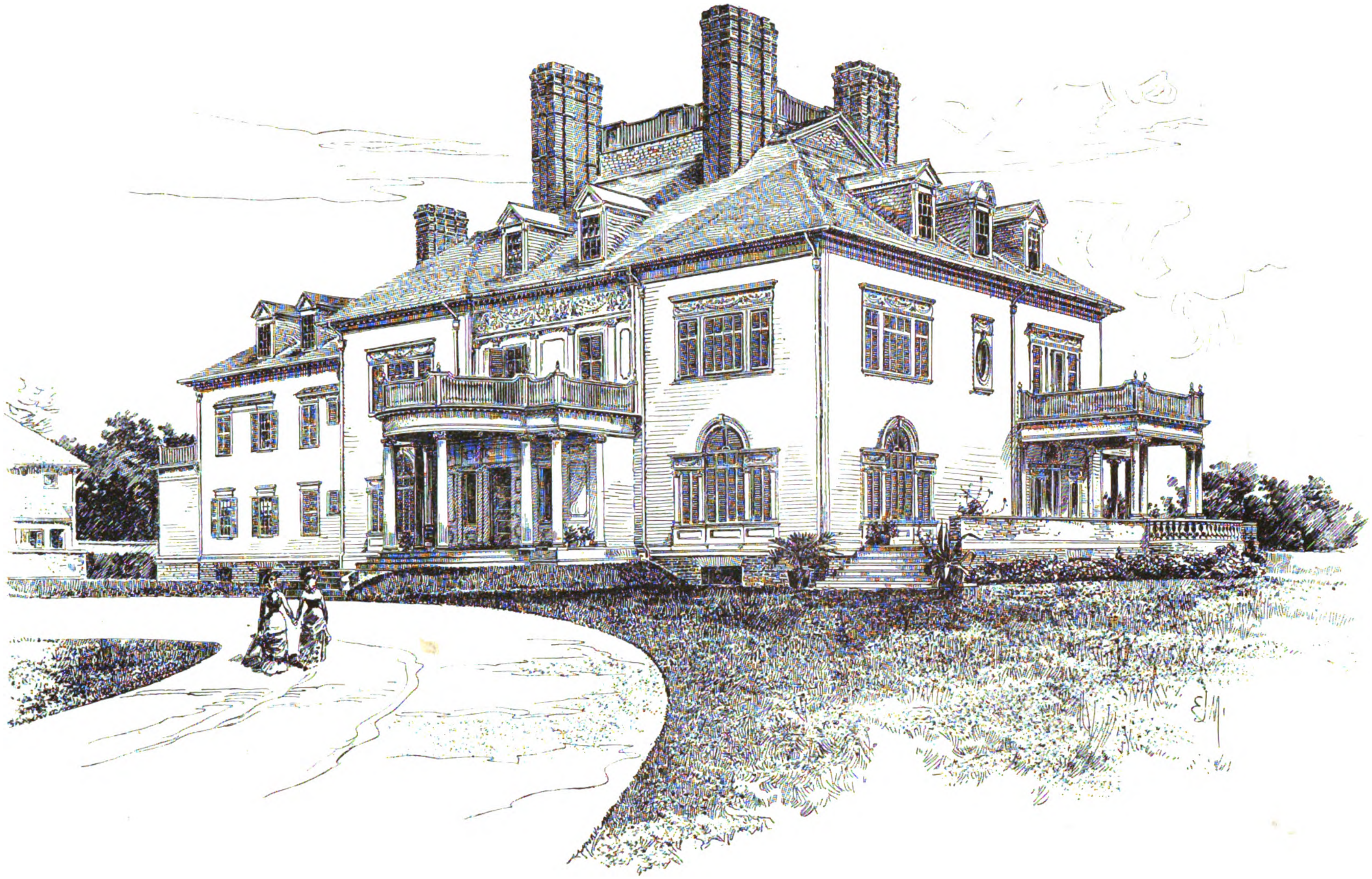
La Nature describes a new apparatus designed by Messrs. Panon & Floran de Villepigue, C. E., which will automatically record the profile and direction of any road it may be drawn over. It is a three-wheeled truck 2'8"x2'8", weighing about 220 pounds, to be drawn over the surface of the ground with a regular motion. Gears on the wheels and a measure level or plumb give motion to two sets of pencils which trace the profile of the ground on a vertical drum at a given scale, and the directions by means of radial lines and centre angles measured by arcs on a flat sheet of paper. Of course it is a delicate instrument and needs fine adjustments. It is christened the Autographometer.



A HOUSE AT BUFFALO, N. Y.—SILSBEE & MARLING, ARCHITECTS.

RESPONSIBILITY FOR CROWDED SCHOOLS.

POUGHKEEPSIE, May 9.—A decision was handed down at General Term this afternoon of interest all over the State. It is entitled "August Nichol against the Brooklyn Board of Education." It was brought primarily to compel the board to furnish accommodation in primary schools for the children of the petitioner, who lived in a growing district where a new school had been recently erected but had filled up beyond its capacity by a growth of population. The children of the petitioner and others were crowded out of the school and the petitioner raised the point that the board had no right to spend money on the higher branches while the primary branches are not satisfied. As to room, Judge Cullen, the trial judge, denied the motion for a writ of mandamus, and an appeal was taken from his decision. The present General Term affirms the decision, holding that the Board of Education can only determine the number and location of schools and ask for an appropriation to build and the Common Council must make the appropriation.—*N. Y. Tribune, May 10.*



THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

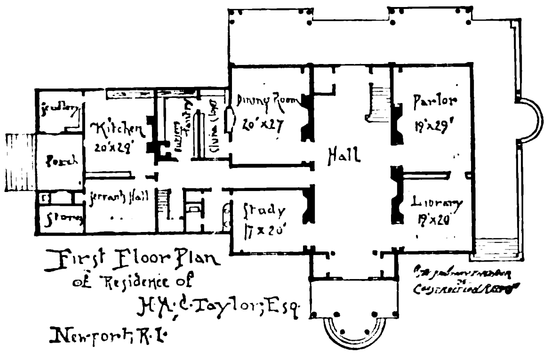
RESIDENCE OF H. A. C. TAYLOR, NEWPORT, R. I.

McKIM, MEAD & WHITE, ARCHITECTS.

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

RESIDENCE OF H. A. C. TAYLOR, NEWPORT, R. I.—M'KIM, MEAD & WHITE, ARCHITECTS.



OUR ILLUSTRATION OF A MODERATE-COST HOUSE.

THE subject of our vignette illustration this week is a house owned by Mr. Edward B. Smith at Buffalo, N. Y. Exterior is shingled. Pine finish, except stairs, which are of cherry. The architects were Silsbee & Marling, of Buffalo.

COTTAGE (SMALL) HOSPITAL CONSTRUCTION.

BY HENRY C. BURDETT.

Author of Cottage Hospitals, Pay Hospitals of the World, etc.

No. XIV.

PRINCESS ALICE MEMORIAL HOSPITAL, EASTBOURNE.

THIS very charming building has been erected by the inhabitants of Eastbourne as a memorial to the late Princess Alice, who, during her lengthened stay in the town in 1878, made herself much beloved by many kindly acts. The site, which was the gift of Mr. C. D. Gilbert, is close to the railway-station, and is on the chalk.

The building is composed of three groups—a central one two stories high, and two wings of one story connected with the central block by low corridors. The style adopted is a simple and appropriate treatment of the English domestic work so familiar in the cottages and farmhouses of Sussex—red brick walls, with red tile roofs and weather-tiling, while the upper part of the central block is half timber-work. The walls are built hollow, with a 2-inch cavity; the bath-rooms, water-closets, and lavatories are lined inside with white glazed bricks. The floors of the wards are laid with oak in narrow widths and wax-polished.

The front of the hospital faces north-west. The main entrance is in the middle of the central block. A covered porch gives access to the hall, which is in the form of a T, and is furnished with seats and a fire-place.

On one side of the entrance-hall is the surgery and operating-room, and on the other the matron's sitting-room, staircase to upper floor, and a water-closet for the staff.

Beyond are the kitchen offices, together with a linen and work room, and a room for the porter.

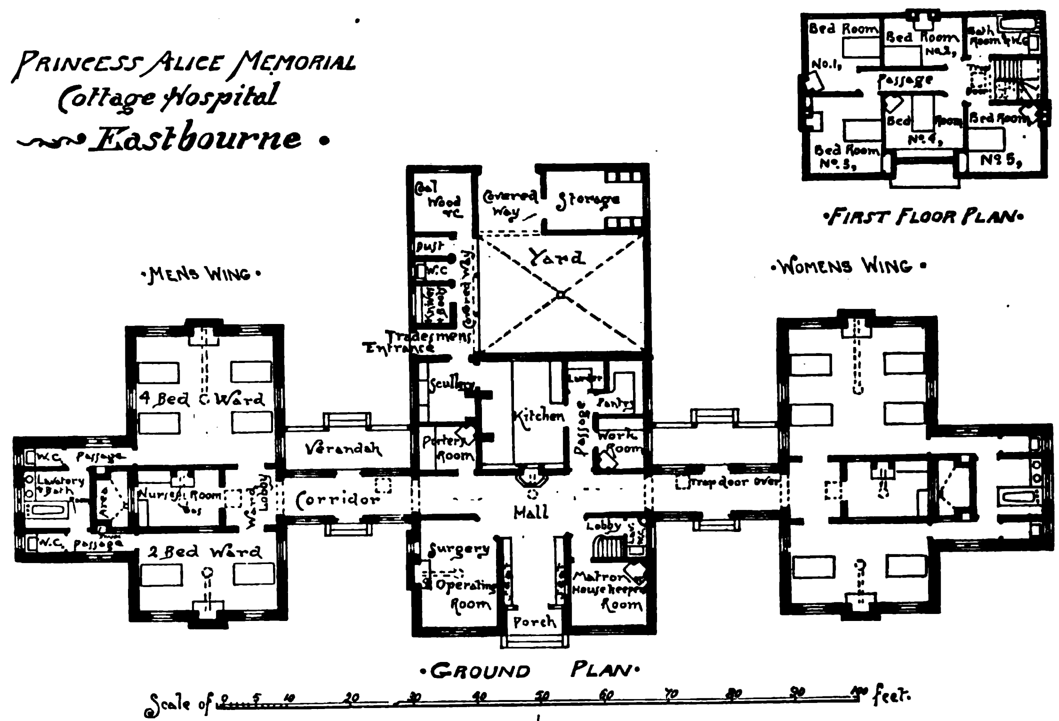
A separate entrance for tradesmen is placed at the side of the scullery, and an enclosed yard, in which are knife and boot-cleaning room, water-closet and stores for coals, etc., is provided in connection with the kitchen offices.

The upper floor of the central block contains five bed-rooms for the staff, with a bath-room and water-closet for their use. The latter would have been of more service had they been divided instead of being in the same room.

The wards are placed in the side wings, and are, as before mentioned, connected by corridors with the central building—an arrangement in every way to be commended, as not only does it prevent the smell of cooking from reaching the wards, but there is greater freedom of circulation of air around and about the wards.

On each side are two wards, one for two beds, the other for four beds, with a nurses' duty room, or ward scullery, between the two. The closets, bath-room, and lavatory are placed in a projecting building connected with each ward by a cross-ventilated lobby. In these lobbies are placed the ward-sinks—a very bad arrangement, as there is precisely the same necessity for isolating the sinks into which the excreta of patients is emptied from the ward atmosphere as there is for isolating the water-closets.

The wards are warmed by Galton's ventilating-grates, and the ward-flues are so constructed that they can be swept from outside the building. Ventilation is effected by means of the windows, which are formed in two portions, the lower portion being ordinary double-hung sashes, the upper portion being a sash hinged to fall inward and with glass hopper sides to prevent draught. In addition to the windows, provision for the admission of fresh air is made under each bed.



Flues warmed by gas are provided to all rooms for the purpose of carrying off the vitiated air.

All the gas-lights are enclosed in locked globes, and the products of combustion carried off into the ventilating-flues by pipes.

All the waste-pipes from sinks, baths, and lavatories discharge over open-trapped gulleys. The drains are all outside the building, are ventilated close to the entrance to the sewer and again at the highest points, and are flushed by two of Field's automatic flushing-tanks.

The hospital was erected from the designs of Mr. Thomas W. Cutter, F. R. I. B. A.

ARCHITECTURAL PUPILAGE.

IN the Journal of Proceedings of the Royal Institute of British Architects of March 3, Mr. William Woodward sums up his views on Architectural Pupilage in the form of advice to a father who thinks of making his son an architect, as follows:

(1) Very carefully consider whether he is not, from inclination, physique, and character, better suited for some other business.

(2) Make quite sure that he has received a sound education in the three R's—so that the first year of pupilage may not be taken up in teaching him to spell and write correctly, add a few figures together, square dimensions, and generally in preparing him to receive that special education for which you have paid a premium.

(3) Before placing him in an architect's office, give him a couple of years' training at the Birkbeck Institution, and a school of art, telling the principals that you propose to make an architect of him. At the end of the two years show his work to an architect friend, and take your friend's advice. If he thinks that your son would do better in the tea trade, or in the church, so let it be.

(4) Do not think that he is in a fair way of doing justice to himself, or to his master, by confining his studies to the office hours. Home studies, schools of art, and the other accessible fields of morning and evening architectural education are absolutely necessary.

(5) Do not think that your son has acquired much more than the rudiments of his business at the end of three or five years of pupilage, or that the architect with whom you have placed him will be able to inject into him the knowledge which his master has taken thirty years of practice to acquire.

(6) At the end of his three or five years of pupilage, put him into another architect's office for, say, another five years, as an improver. This will enlarge his mind, and get him out of a few awkward grooves into which he slipped in the first office; or, better still, if within your power, let him commence practice on property which is entirely your own.

(7) Unless you have friends who will secure him employment at the end of his educational career, settle the largest annuity you can upon him: he will require it.

(8) There are abundantly ample (perhaps too many) sources of architectural knowledge open to your son; the rest is in his own hands.

RECENT SEWER CONSTRUCTION.

No. VI.

(Continued from page 602.)

THE IMPROVED SEWERAGE SYSTEM IN NEWARK, N. J.

[Prepared for *The Sanitary Engineer and Construction Record* by F. COLLINGWOOD, M. Am. Soc. C. E. and M. Inst. C. E.]

RETURNING to a consideration of the sewer sections, the uppermost, as shown in Fig. 2*, had an oval form 2'10"x3'8". The rubble masonry is random work, laid in cement mortar mixed 2 sand to 1 of "Improved Union" cement from Egypt, Pa. The neat cement was required to stand 60 pounds tensile strain in 24 hours, the characteristics of this cement being that it is quick-setting, with good subsequent results. The "collar" joint was 6 inches thick at the bottom, starting directly on the planking, and from 2 to 4 inches thick at the sides. It was made of 1 part of the cement described, with from 3 to 5 parts of gravel or small broken stone. This, after setting, was evened up with cement mortar to a true surface, on which the brick-work was laid.

The mortar for the latter was of Portland cement mixed 2 to 1.

In all cases the rubble filled entirely the space between the lines of sheeting up to the spring of the arch; and the lower portion of the sheeting was always left in place. The object of the latter precaution was to prevent an excessive load from coming upon the crown of the arch. This was likely to occur as a result of the settlement due to the hollows left outside the sheeting by the running in of the quicksand. An incipient longitudinal crack discovered at one point in the crown of the sewer where the trench had been narrowed up so as to make the walls too light, showed the necessity of this precaution.

In a few cases the continual pumping for construction beyond, undermined the sections already built within 15 to 25 feet of the pump-well so as to require them to be torn down, the bottom relaid, and the work rebuilt.

The usual rule was to leave the centres in for 24 hours, during which time 3 feet of earth were filled in on the crown of sewer. The remainder of the filling was put in after 6 or 7 days' time.

The Carson trench machine was used over a portion of the work.

The brick-work in section No. 1 is 8 inches thick.

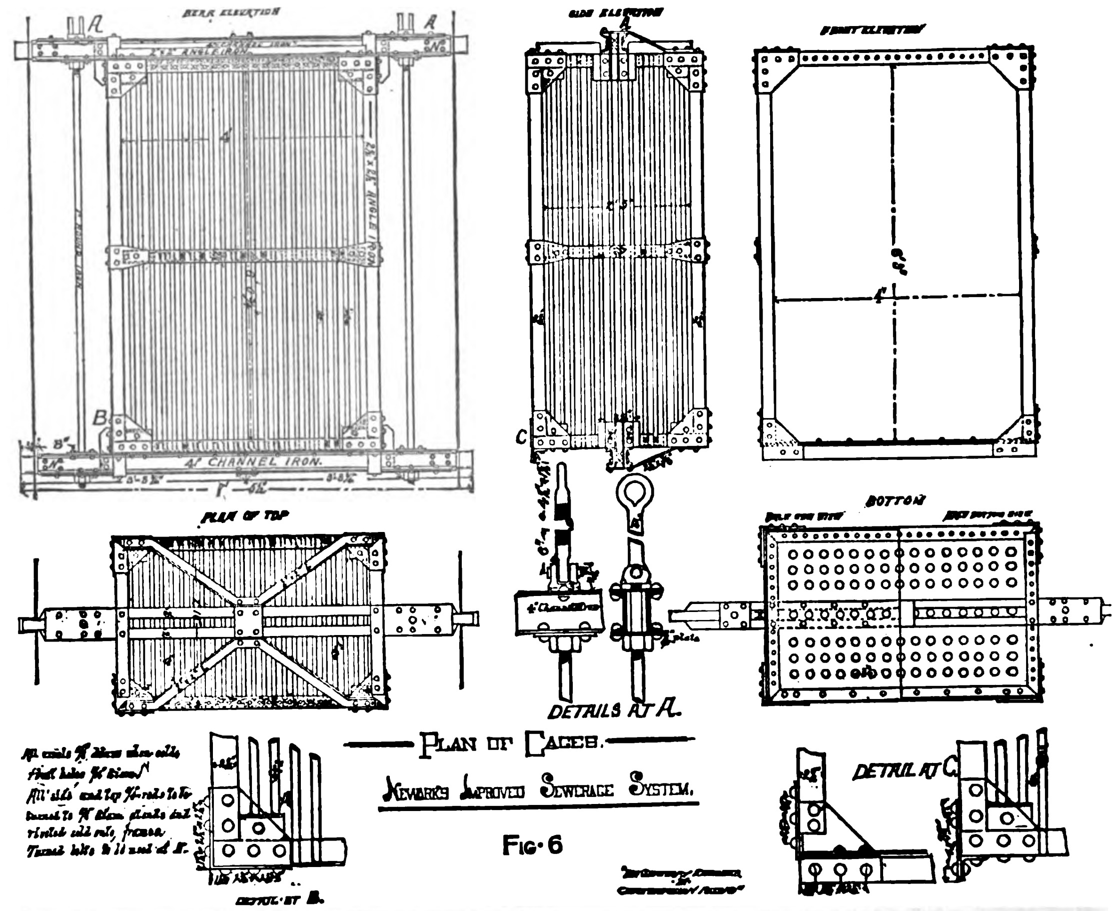
The estimate made by the engineers was based on the bottom of the trenches being opened 6 inches on each side, wider than the brick-work. The bad ground obliged them to increase this to 12 and 18 inches, the latter being on the side where the drain-pipe was laid.

The original plan contemplated also the use of an 8-inch arch throughout. As constructed, however, from Dawson Street down the arch was 12 inches, as shown in sections 5 to 8, and a considerable portion of the sewer below Earl Street was built, as shown, with a 12-inch arch, the 8-inch being used only where the ground would allow it safely. The inverts were 8 inches throughout. Another reason for thickening the arch was, that with all the care exercised, water was still found to percolate through it from the exterior, where it was but 8 inches thick, and it was deemed desirable to increase it for this reason. Where it is not essential that the ground-water be excluded, the 8-inch arch would in most cases have sufficed. The enlargement at Sanford Street is to accommodate the flow from the east side and Passaic sewers whenever they may be built.

* For illustrations, Figs. 1, 2, 3, 4 and 5, see last issue.

An interesting test of the strength of the work was made in closing a gap in the main sewer at the intersection of South and Dawson Streets. The two ends had been built up about a year, and the gap left was to accommodate the flow of a surface-ditch, which could not be otherwise disposed of. A tight sump of matched boards was made with a tight board bottom at the level of the bottom of the foundation planks of the sewer, and into this the 12-inch drain-pipes shown in section No. 5 were led. The influx of fine sand was prevented by packing salt hay around the sump. Tight bulkheads of brick-work 8 inches thick, laid in Portland cement, closed the ends of the sewer (the section being 4' 3"x5' ½"), and the sewer above was filled with water, so that the depth as measured at the manhole was 16 feet, giving a head at the crown of 11 feet. Although the sewer was uncovered down to foundation for some distance back of the bulkhead, there was no evidence of leakage, and the level of the water remained constant for several weeks.

This brings us to the deposit sewers. The right-hand section of Fig. 3 is taken across the lower end of the main sewer, being the inlet to the deposit sewers, the entrance being by a short coned section. Figure 4 is a vertical longitudinal section, and Fig. 5 a horizontal longitudinal



PLAN OF CAGES.
NEWARK'S IMPROVED SEWERAGE SYSTEM.
FIG. 6

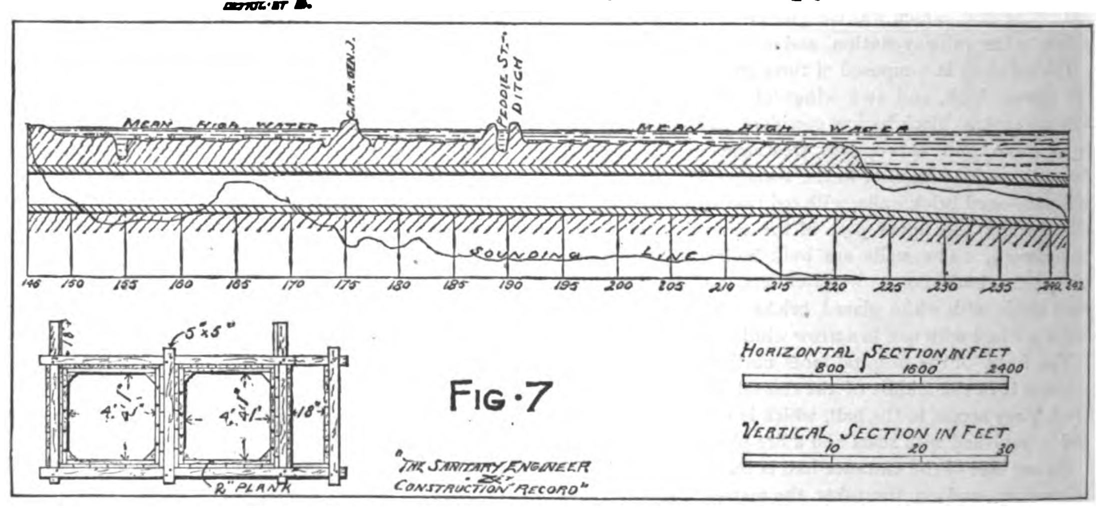
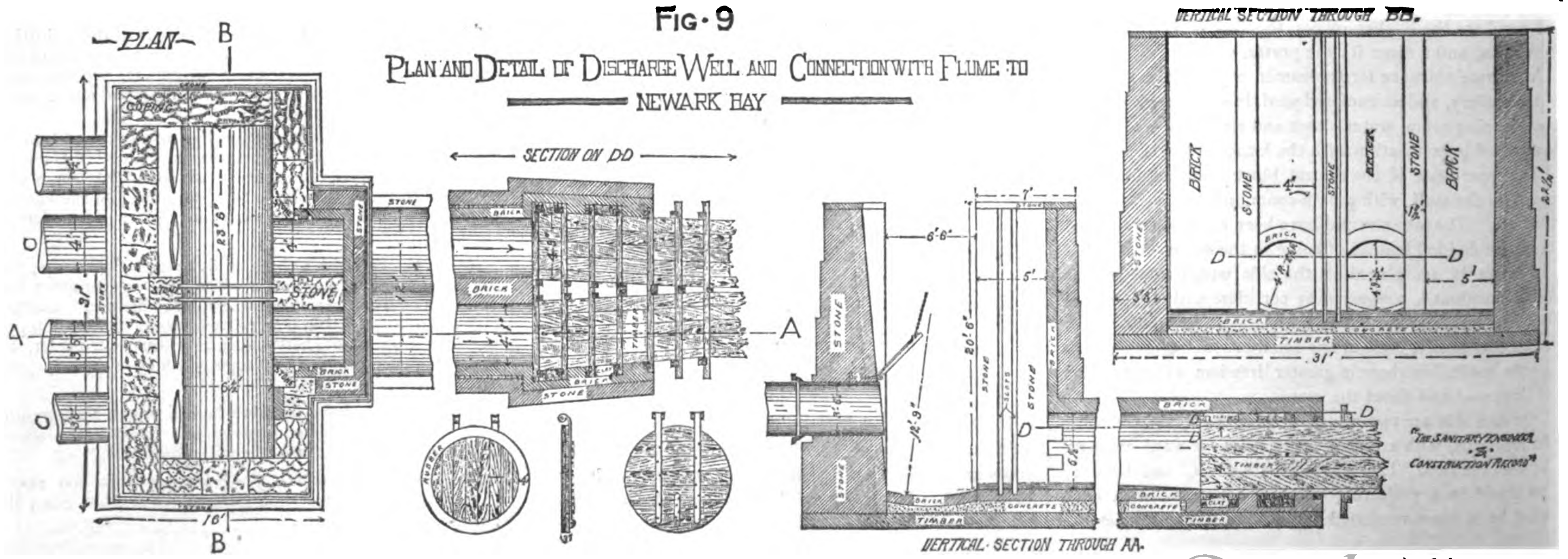


FIG. 7

FIG. 9

PLAN AND DETAIL OF DISCHARGE WELL AND CONNECTION WITH FLUME TO NEWARK BAY



section of the deposit sewers. It will be seen that a man-hole is provided at the upper end with a cross-tunnel for access. Provision is also made for a double set of stop-planks at each end, so that either sewer can be drained to allow the removal of sedimentary matters. At the middle point of each sewer are manholes 3 feet 4 inches in the clear, to allow the removal of filth by buckets and a derrick; and on each side, at the same point (as indicated), access to the sewers can be had by inclined archways with steps below.

Just below section E F, Fig. 5, slideways are shown which are for gates to close entirely the entrances to the passages to the filth-hoists and well, should the necessity arise. It will be noticed also in Fig. 4 that there is a drop of 2 feet at the inlet and of 10 inches at each set of cages, and the suction-pipes are so placed as to practically drain everything dry as far as the entrance to the pump-well, a slight grade being given to the deposit sewers for this purpose.

Figure 3 shows sections across the deposit sewers. The foundation timbers were 6x12 inches, and the planking 3 inches thick. The rubble of the side walls was from 12 to 18 inches thick at the spring, always vertical, and always filled out to the sheathing. A space of 1 to 2 inches inside of these was plastered to a true surface with ordinary cement-mortar, inside of which brick-work was laid in Portland cement. This work and the inverts were 8 inches thick. The concrete underneath was 6 inches deep at the centre.

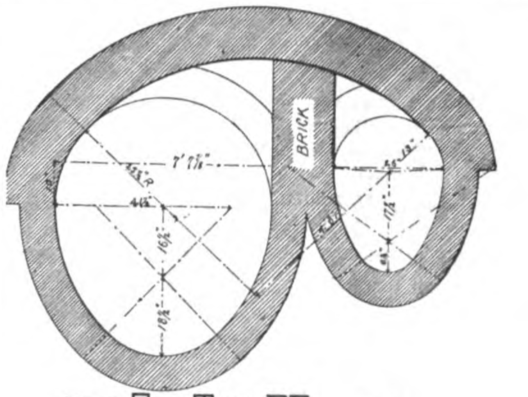
The section E F is just in front of the cage-chamber. The plan shows four cages, or filth-hoists, in position, and arrangements are made for hoisting these to the floor above for cleansing. The chamber is surmounted by a brick building, 19x25 feet, for protecting the hoisting machinery from the weather. Figure 6 gives full details of one of the filth-hoists. They are built entirely of iron, the bars being ¾-inch round. They will be counter-weighted, and for the present worked by hand.

From the cage-chamber the sewer is reduced by a conical section to that shown at G H, and thence enters the pump-well, which is 46 feet long, 8 feet wide and 16 feet high at the centre.

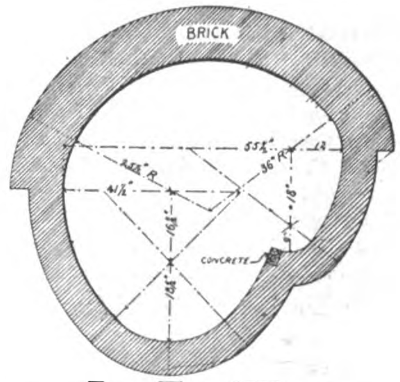
The invert drops 3 feet on entering the pump-well, the invert of which is 20 feet below mean high tide. From here the sewage passes by four 36-inch suction-pipes to as many special pumps. Since these pipes will not entirely drain the well, a 12-inch pipe (not shown) is carried upward from a point within four inches of the bottom of the well, and turned through into the pump-house; from here it is carried up and through into the discharge-well at the bottom at an elevation of 8 feet below tide. A stop-valve is placed in the vertical portion of this within the pump-house, and an attachment made *below* the stop-valve for the suction to a small steam-pump, and another attachment *above* the stop-valve for the delivery pipe from the pump. By this means the water can at any time be pumped past the valve and into the discharge-well. If, on the contrary, it becomes necessary to drain the discharge-well, or even the box-drains, for some distance beyond, it can be done by opening the stop-valve and allowing the water to run back into the pump-well. Gauges are attached to this pipe for indicating the height of sewage in the two wells. The boiler-room is 61x43 feet, and the pump-house 52'8"x48'; a view of the latter is given. The design for the buildings was furnished by Mr. R. H. Rowden, architect, Newark. The floor where the pumps rest is 14 feet below tide, and the engine floor 10 feet below tide. This arrangement is made to bring the pump and engine cylinders (which are horizontal) in line. The wall between the pump-well and the pumps is three feet thick, and will have a head of water against it at times of about twenty feet. There is a small buttress at the centre only, and it is evident that the wall acts as a beam, and its strength is due to the Portland cement, and the care with which it was laid. A 6-inch ventilating-pipe is carried from the pump-well to the smoke-stack for the removal of noxious gases.

From the pumps, which, with the engines, will be described further on, the sewage passes through the discharge-pipes shown in Figs. 4 and 5 to the discharge-well. These pipes are 30 inches, expanding into a 42-inch, as shown in Figs. 4 and 5.

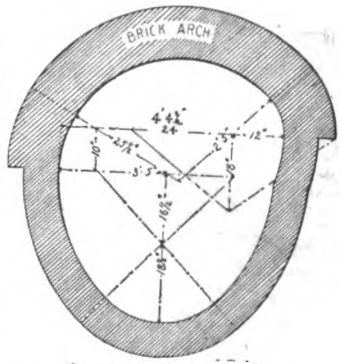
Figure 9 gives details of the discharge-well, and the connection with the flume. The present connection will be through the pipes C C; but when the system is complete, and provision is made for a daily discharge of 50,000,000 gallons more, the latter will be passed through the two 4-foot pipes, and the present discharge will be



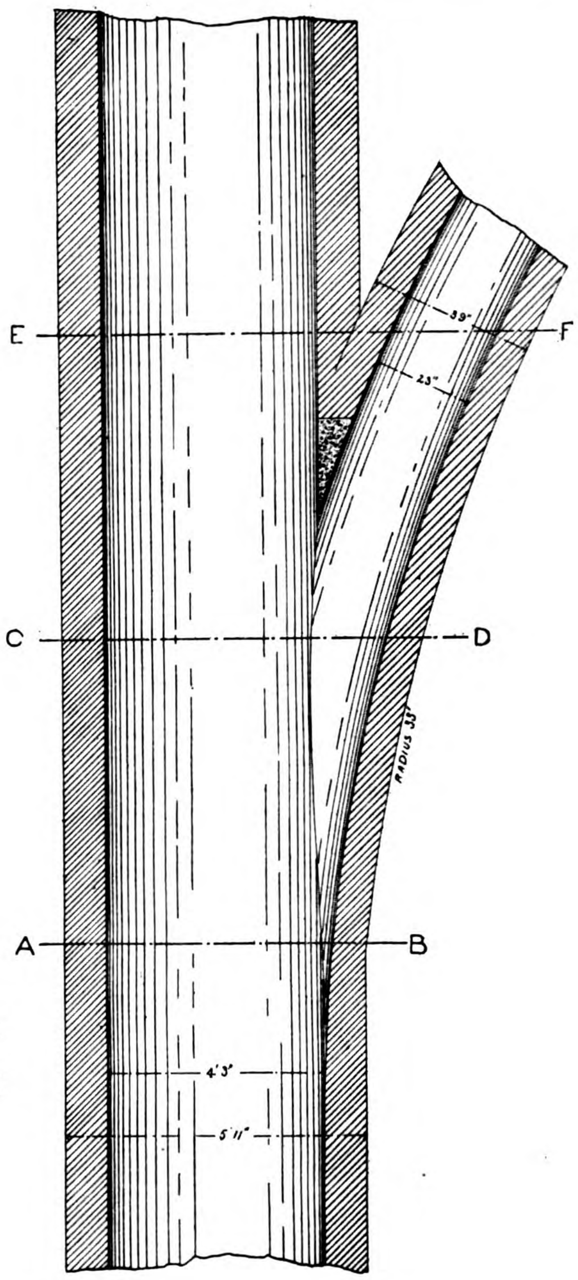
— Section Through EF —



— Section Through CD —



·Section·Through·A-B·



Fig·8
JUNCTION OF
McWHORTER ST.
AND
10th WARD DITCH
SEWERS

changed to the two 3'6" pipes. Grooves are arranged for a double set of stop-planks in the discharge-well, so that either half can be cleansed. To prevent influx from the flumes stop-planks are provided for also in the outlets. Flap-valves are provided over the ends of the discharge-pipes from the pump. These are ordinarily triced up by chains, but can be closed when necessary for repairs to pumps, etc.

Provision is made at the opposite side of the pump-well for inserting the suction-pipes for the second system of pumps when required. The pump-house for the second set of machinery will not be built until needed.

The discharge-well, pump-well, and deposit-sewers are of sufficient size to pass 100,000,000 gallons daily if required. The discharge-well is built of rubble masonry, with stone quoins at the interior angles and also midway of the length, the interior of the rubble-work being cemented to a flat surface. One side as shown is brick-lined. The walls are coped with 4-inch flagging, and the opening will be covered with planking.

The flume (see Fig. 7) was at first designed to be single and 5 feet square, but was finally made double (each opening 4 feet 1 inch square), so as to make the system duplicate throughout. The diminished depth made it more flexible, and less liable to derangement while building. It gives the further advantage, also, of increased velocity of flow when the quantity pumped is small, by passing all the sewage through one compartment. The frames are 5x5 inches, notched together as shown in plan, and fastened by locust treenails. The exterior verticals are carried up 18 inches and planked above the frame so as to retain sufficient earth on top to sink the flume. The frames are placed at 4 feet centres for about half the distance from the bay, and at 2 feet centres from there to the pumps. The flume is formed of double thicknesses of 2-inch hemlock plank spiked on, of which the inner is tongued and grooved. The inside planks above and below are placed crosswise, and for additional stiffness and tightness, interior angle-strips are treenailed on throughout. One thickness of plank is placed outside of the verticals to resist the earth-pressure. A tight junction was secured with the masonry at the exit from the discharge-well by means of recesses left in the masonry, which were filled with clay puddle. The trench for the flume was dredged entirely across the meadows to 20 feet width and a depth of 8½ feet below high water, the grade of the bottom of the interior being about 8 feet below tide. The flume was built continuously from a float, 16 feet being built at a time, after which the float was drawn forward and another length added.

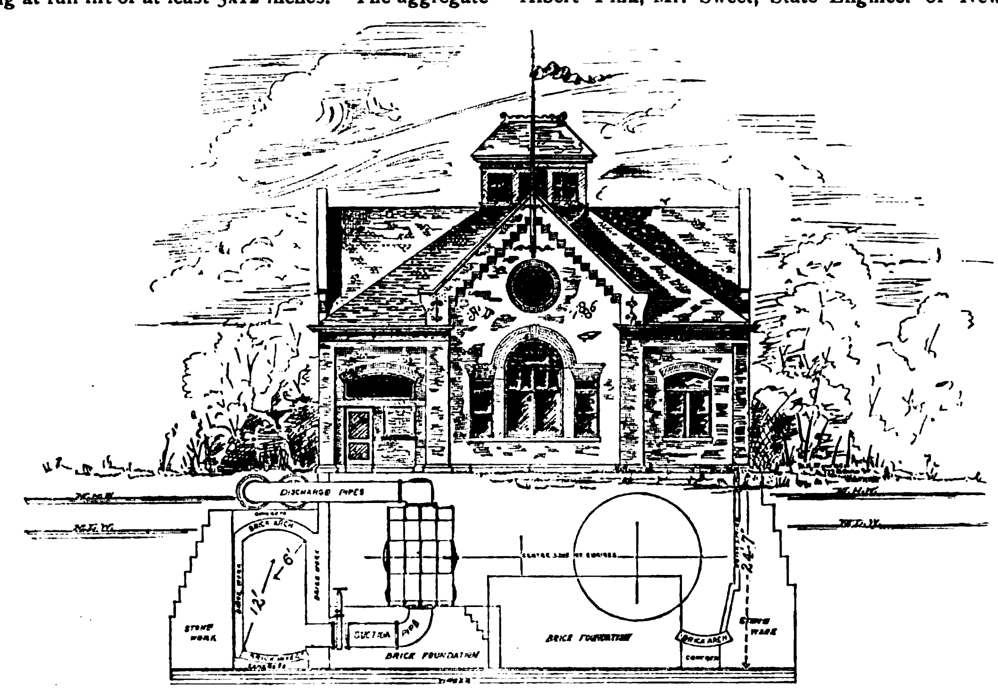
The planks were made to break lengths by at least four feet. At about 100 feet back the filling was being placed on top for sinking the flume to the bottom, and as the tide had free admission all that was required for this was enough to overcome the buoyancy of the timber.

Work was carried on from two points, working upward, the lower end of the finished section being held up part way, but so that water entered and filled it at high tide. This was discharged more quickly than the water from the ditch at the upper end (the direct flow outside the box being cut off by filling) could flow back through cross ditches to the Bay. The extra lifting strain thus brought on the unloaded end of the box by its being partly empty caused rupture. This made it necessary to put in stop-gates at about one-third of the distance to the Bay. A second set were placed at sixteen feet below the discharge well to facilitate completion of the upper end, and a third set near the Bay end. The extreme outer end has the bottom placed fifteen feet below tide. A crib protection eleven feet thick filled with stone and floored each way from the mouth for about forty feet protects it from ice and gives opportunity for dredging, etc. The box is placed below the level of the mud in the Bay. This portion of the flume had the horizontal timbers extended as shown at

the right-hand side of section in Fig. 7, so as to form pockets eighteen inches wide, which were filled with stone for sinking. Soundings, recently made the whole length, show the flume to be in excellent condition.

The average lift of the pumps, it is calculated, will be twenty feet, and should necessity arise the sewage can be discharged under a head of ten or eleven feet even at high tide. The ordinary head of discharge is, however, calculated at three feet.

The pumps are of special design. The piston is 36 inches in diameter with 36-inch stroke, and works through a diaphragm which divides the pump into two parts, each with a series of small inlet-valves below and of delivery-valves above. By this arrangement the pump-chamber on one side is filled as the piston withdraws from it, while water is displaced from the other chamber equal to the bulk of the piston. The latter is made hollow to diminish weight and friction. The engines are of the same number as the pumps, but connected in pairs (with cranks at right angles) to two shafts, each having a heavy fly-wheel 16 feet in diameter. The steam cylinders are 20x36 inches. The engines are guaranteed to each pump 15,000,000 United States gallons twenty feet high in twenty-four hours when running with an average piston speed of 110 feet per minute, and to be capable of varying this speed between the limits of 15 and 150 feet. The water-valves to be flat, of rubber or leather, placed upon suction and force plates on an incline from the vertical; to have a clear lift of at least three inches, and a clear opening at full lift of at least 3x12 inches. The aggregate



NEWARK SEWERAGE.—ELEVATION OF PUMPING-STATION.

opening of the suction-valves to exceed the area of the plungers, and that of the delivery-valves to about equal that of the plungers.

There are three boilers 16 feet long and 5½ feet in diameter, each having 64 tubes, 3½ inches in diameter. These are connected by a breeching to a brick chimney 12 feet square at the bottom and six bricks thick for twenty feet high. Thence changing to an octagon and reducing by internal offsets and external batter to six feet in diameter and three bricks thick at a total height of 125 feet. There is an internal tube of fire-bricks, fifty-five feet high, four feet internal diameter and eight inches thick, which receives the products of combustion.

The pumping-engines are known as the "Watts-Campbell Co. duplex condensing sewage-pumping engines," and are under contract with this company.

We hope to present detailed illustrations of them later.

Figure 8 shows the method of connecting a contributing-sewer at the corner of Dawson and South Streets.

The piece of junction sewer shown is about 40 feet long and comes in at a rapid descent. The McWhorter Street sewer discharges into a large domed basin, the invert of which forms a sump to catch sand and detritus. The discharge into the junction sewer has its invert 2 feet higher, and the entrance is closed by a slide-gate worked by a screw from a manhole, so that the amount of sewage entering can be at all times positively adjusted. From the basin a second outlet passes to the old channel of the Tenth Ward ditch. This outlet is provided with two sets of folding-gates so set as to open towards the incoming tide and slightly upward. In this way there is a tendency for them to remain closed always against the tide, and force the sewage to enter the junction sewer, while they are free to open when necessary to accommodate any increase of flow from the old sewer beyond what is allowed to enter the intercepter. The same system is to be adopted at all the intersections with the old sewers.

The sewers have recently been cleaned out and carefully examined, and, notwithstanding the head of water outside, they are found to be remarkably free from leakage, an occasional small jet of water only being seen, and these are easily stopped.

We are indebted to the office of the Engineer and Superintendent for access to the detail drawings and information with regard to the progress and obstacles met with during construction.

The engineer and contractor deserve great credit for the thoroughness with which they have accomplished a difficult undertaking.

THE MICHIGAN AND ILLINOIS AND THE PROPOSED HENNEPIN CANALS.

IN response to a request the Secretary of War transmitted to the House on January 10, a lengthy report of the Board of Engineers appointed to examine the subject, consisting of Colonel C. B. Comstock, Colonel O. M. Poe, and Major J. C. Post.

The board first give an interesting discussion on the comparative cost of moving freight by rail and by water, giving tables from various sources, and the opinions of Mr. Albert Fink, Mr. Sweet, State Engineer of New York, and other authorities. Their general conclusions under this head are, that "it does not seem possible that under the most favorable circumstances railroads can profitably convey large amounts of freight at less than .4 of a cent per ton mile, while for most roads this figure would rise to .5 or .6 cents."

They then show that the rates by lake between Chicago and Buffalo in 1885 were as low as .04 and up to .08 cents per ton mile for grain, and on the Erie Canal they averaged .33 cents, with a least rate of .27 cents. Mr. Sweet gives the average on the canal for 1884 as .29 cents. This last the board consider as the least rate at which a profit can be made on the canal, and .08 as similarly the least on the lakes.

The rate from St. Paul to St. Louis by river, 700 miles, they think can be made profitable for large amounts of freight at .3 cents; and with locks 170 feet long, 30 feet wide and 7 feet deep on the proposed Hennepin Canal and the Illinois and Michigan, rates should sink to .2 cents. With freight between Chicago and the Mississippi at $1, the use of anthracite coal would be greatly increased, and it might be made less.

The board conclude that "the waterway from Chicago to the Mississippi will be valuable and useful to navigation; that it will give a waterway from Chicago to St. Paul over which freights of low cost and not demanding the most rapid transit can be transported at rates much below existing rates by rail, and that the influence of this waterway in reducing rates of freight will probably extend west of the Mississippi."

They then describe the Hennepin route as extending west from the great bend in the Illinois River near Hennepin by the route they think most feasible, 64 miles to the Mississippi near Albany (about 30 miles above Rock Island). They propose a canal 80 feet wide on the surface, with locks as previously mentioned. There will be in ascending 205 feet to the summit 23 locks, and in descending 75 feet to the Mississippi 8 locks. A feeder, 37 miles long, from Dixon will be required. The estimated cost of construction is $5,811,367.50.

As a part of the system the Illinois and Michigan Canal is considered. This extends from Chicago to La Salle, 97¼ miles long. This is 60 feet wide at top, 36 feet at bottom and 6 feet deep in earth; and 48 feet wide in rock, with locks 110x18 feet and 6 feet deep on mitre-sills. The lifts from the lake 39.7 feet to summit-level are by 4 locks, and the descent to the Illinois River 100.25 feet by 11 locks.

From La Salle navigation is obtained to a point about 40 miles above St. Louis by means of the Illinois River, which is now in course of improvement to furnish a 6-foot navigation.

It will be seen by this description that these two canals cover the total space between Lake Michigan and the Mississippi, except the gap of 17 miles below La Salle, which is now traversed by means of the Illinois River. The State of Illinois have passed an act of cession of the Illinois and Michigan Canal to the general Government, but the engineers very justly point out that the Government under this act would possess the two *ends* of a route—viz., the two canals—but the central portion would be under control of another authority and subject to tolls for its maintenance. They consider that a canal past this portion would be less costly than the improvement of the river itself.

They comment still further on the general subject of transportation, quoting Mr. Fink as saying: "Water routes not only control the tariffs of their immediate railroad competitors at points where they can render like service to the same people, but their influence reaches directly and indirectly to the remotest part of the country."

They say: "It is a matter of little consequence whether the canal carries *any* freight or not, so long as the fact that it is there, and in readiness for the purpose, affects the charges by rail, reducing them to such extent that shippers prefer land transportation."

They next discuss the terminus at Chicago through which all the traffic must pass, the numerous draw-bridges, and the delays and annoyances caused by passing vessels. This would almost of necessity require a change of terminus when the traffic shall be largely increased, as it undoubtedly would be when the Hennepin Canal is completed.

They finally report against the acceptance of the old canal for the reasons given, except under modified conditions.

A large amount of statistical information respecting present traffic and cost, the present and proposed canal routes, etc., all of value to the engineer, is given in the appendix.

REPORT OF THE SEWER COMMITTEE OF SCHENECTADY FOR 1886.

FROM this report we learn that during the year 16,909 feet of sewer have been built, making a total of 13.1 miles, costing 68½ cents per lineal foot, average of all sizes including 18-inch main.

There are 30 Van Vranken, 1 Field, and 1 Pierson flush-tanks in use, which are set to discharge about 200 gallons from once to three times in 24 hours, and all but the last have worked well. To prevent freezing of the supply-pipe the discharges were increased in severe cold weather.

A weekly inspection of tanks and manholes has been kept up, costing for maintenance $233. The experience with flush-tanks is thus described. No stoppage has occurred on any sewers flushed by tanks.

"There have been 30 Van Vranken, 1 Field's, and 1 Pierson's flush-tanks in use in the old work, and 5 Van Vranken tanks in the new. The Pierson tank has caused much trouble by the movable parts becoming covered with frost in winter and failing to act. The Field's tank though slow in action has worked well. The Van Vranken tanks are the most powerful and have worked perfectly.

"The tanks have been set to dump from once to three times in 24 hours according to the needs of the locality. During severe winter weather more water has been used in the tanks than was necessary for flushing, to prevent the freezing of the service-pipe from the water-main."

In some of the flat sewers slight deposits of quicksand have been successfully removed by the use of a "pill consisting of two hemispheres of heavy sheet-copper brazed

together to form a sphere and strengthened by an iron rod. The rod passes around the sphere in a depression so as to not extend beyond its surface, and has a ring formed in it by which to attach a rope. The pill is usually 2 or 3 inches less in diameter than the pipe in which it is to be used.

An illustrated description of these sewers will be found on page 491, issue of April 22, 1886, Vol. XIII. John L. Fitzgerald is engineer in charge of construction, and William B. Landreth is Superintendent of Sewers.

DOMESTIC PLUMBING HEATING LIGHTING & VENTILATION ENGINEERING

NEW YORK TENEMENT-HOUSE ACT OF 1887.

SECTION 296. The board of police upon the requisition of the board of health, shall detail to the service of the said board of health, for the purpose of the enforcement of the provisions of the sanitary code, and of the acts relating to tenements and lodging-houses, not exceeding forty-five suitable officers and men of experience of at least five years' service in the police force, provided that the board of health shall pay monthly to the board of police a sum equal to the pay of all officers and men so detailed. At least fifteen of the officers and men so detailed shall be employed exclusively in the enforcement of the laws relating to tenement and lodging-houses. These officers and men shall belong to the sanitary company of police and shall report to the president of the board of health. The board of health may report back to the board of police for punishment any member of said company guilty of any breach of orders or discipline, or of neglecting his duty, and thereupon the board of police may detail another officer or man in his place, and the discipline of the said members of the sanitary company shall be in the jurisdiction of the board of police, but at any time the board of health may object to the efficiency of any member of said sanitary company, and thereupon another officer or man may be detailed in his place. The board of police shall have the power, and it shall be their duty to fill all vacancies in the police force in the city caused by the detailing of said officers and men upon the requisition of the board of health. And the board of police are hereby authorized and empowered to appoint fifteen additional men to the police force subject to all the law, rules and regulations relating to and governing the appointment of patrolmen in said city.

SEC. 533. The authority, duty and powers of the board of health shall extend over the waters of the bay, up to and within the quarantine limits as established by law, but shall not be held to interfere with the powers and duties of the commissioners of quarantine or health officer of the port. It shall be the duty of the board of health to make an annual report to the Mayor of the city of New York of all the operations of the said board for the previous year. The Mayor may at any time call for a more full report, or for a report upon any portion of the work of said board whenever he may deem it to be for the public good so to do. The Mayor and one commissioner from the department of health, the commissioner of the department of public works, one delegate from the bureau of inspection of buildings, and the commissioner of the department of street cleaning, shall meet annually, between the fifteenth day of November and the thirtieth day of December, for the purpose of considering the subject of tenement and lodging-houses in the city, and shall make such recommendations of improvement in the laws affecting tenement and lodging-houses as they may deem to be for the good of the people of the city; they shall cause such recommendations to be sent to the Governor of the State, and to the Senate and Assembly annually on or before the fifteenth day of January; they shall also consider the subject of the execution of said laws and shall recommend to the board of health such changes in the same as they may deem to be for the good of the people of the city.

SEC. 585. Said board may establish reasonable regulations as to the publicity of its records and proceedings: and may publish such information as may, in its opinion be useful, concerning births, deaths, marriages, sickness, and the general sanitary conditon of said city, or any matter, place or thing therein. Said board shall prepare and keep the statistics of tenements and lodging-houses, and make semi-annnual reports upon the same to the board of health, which shall transmit such statistics to the State Board of Health.

SEC. 588. Said board may appoint and commission such number of "sanitary inspectors" as the board may deem needful, not exceeding twenty-five, and from time to time prescribe the duties and salaries of each of said inspectors, and the place of their performance (and of all other persons exercising any authority under said board, except as herein specially provided); but at least twenty of such inspectors shall be physicians of skill and of practical professional experience in said city, and the residue thereof shall be selected with reference to their practical knowledge of scientific or sanitary matters, which may especially qualify them for such inspectors.

Each of such inspectors shall, twice in each week, make a written report to said board stating what duties he has performed, and where he has performed them, and also such facts as have come to his knowledge connected with the purposes of this chapter as are by him deemed worthy the attention of said board, or as its regulations may require of him; and such and the other reports herein elsewhere mentioned shall be preserved among the records of said board.

SEC. 649. No house, building or portion thereof, in the city of New York, shall be used, occupied, leased or rented for a tenement or lodging-house unless the same conforms in its construction and appurtenances to the requirements of this title; and if occupied by more than one family on a floor, and if the halls do not open directly to the external air, with suitable windows, without a room or other obstruction at the end, it shall not be used, occupied, leased or rented, unless sufficient light and ventilation is otherwise provided for in said halls.

SEC. 653. Every tenement and lodging-house or building shall be provided with as many good and sufficient water-closets, improved privy-sinks or similar receptacles as the board of health shall require, but in no case shall there be less than one for every fifteen occupants in lodging-houses, and not less than one for every two families in dwelling-houses. The water-closets, sinks and receptacles shall have proper doors, soil-pipes and traps, all of which shall be properly ventilated to prevent the escape of deleterious gas and odors, soil-pans, cisterns, pumps and other suitable works and fixtures, necessary to insure the efficient operation, cleansing and flushing thereof. Every tenement and lodging-house situated upon a lot on a street or avenue in which there is a sewer, shall have a separate and proper connection with the sewer; and the water-closets, sinks and other receptacles shall be properly connected with the sewer by proper pipes made thoroughly air-tight. Such sewer connection and all the drainage and plumbing work, water-closets, sinks and other receptacles, in and for every tenement and lodging-house shall be of the form, construction, arrangement, location, materials, workmanship and description to be approved, or such as may be required by the board of health of the health department of the city of New York. Every owner, lessee and occupant shall take adequate measures to prevent improper substances from entering such water-closets, or sinks or their connections, and to secure the prompt removal of any improper substances that may enter them, so that no accumulation shall take place, and so as to prevent any exhalations therefrom, offensive, dangerous and prejudicial to life or health and so as to prevent the same from being or becoming obstructed. Every person who shall place filth, urine or fæcal matter in any place in a tenement-house other than that provided for the same, and every person who shall keep filth, urine or fæcal matter in his apartment or upon his premises such length of time as to create a nuisance shall be guilty of a misdemeanor; no privy-vault or cesspool shall be allowed in or under or connected with any such house except when it is unavoidable, and a permit therefor shall have been granted by the board of health, and in such case it shall be constructed in such situation and in such manner as the board of health may direct. It shall in all cases be water-tight and arched or securely covered over, and no offensive smell or gases shall be allowed to escape therefrom, or from any closet, sink or privy. In all cases where a sewer exists in the street or avenue upon which the house or building stands, the yard or area shall be connected with the sewer, that all water from the roof or otherwise, and all liquid filth shall pass freely into the sewer. Where there is no sewer in the street or avenue, or adjacent thereto, to which connection can be made, the yard and area shall be so graded that all water from the roof or otherwise, and all filth shall flow freely therefrom into the street gutter, by a passage beneath the sidewalk, which passage shall be covered by a permanent cover, but so arranged as to permit access to remove obstructions or impurities. It shall be the duty of the board of health to enforce the provisions of this section in regard to privy-vaults as soon as practicable, but said board shall permit no privy-vault to remain connected with a tenement-house later than January first, eighteen hundred and eighty-seven,* except in the cases especially named in this section.

SEC. 657. Every tenement or lodging-house, and every part thereof shall be kept clean and free from any accumulations of dirt, filth, garbage or other matter in or on the same, or in the yard, court, passage, area or alley connected with it or belonging to the same. The owner or keeper of any lodging-house, and the owner or lessee of any tenement-house or part thereof, shall thoroughly cleanse all the rooms, passages, stairs, floors, windows, doors, walls, ceilings, privies, cesspools and drains of the house or part of the house of which he is the owner or lessee, to the satisfaction of the board of health, so often as he shall be required by or in accordance with any regulation or ordinance of said board, and shall well and sufficiently, to the satisfaction of the said board, whitewash the walls and ceilings thereof twice at least in every year, in the months of April and October, unless the said board shall otherwise direct. Every owner of a tenement or lodging-house, and every person having control of a tenement or lodging-house, shall file in the department of health a notice containing his name and address, and also a description of the property by street number, or otherwise, as the case may be, in such manner as will enable the board of health easily to find the same; and also the number of apartments in each house, the number of rooms in each apartment, the number of families occupying each apartment, and the trades or occupations carried on therein. Every person claiming to have an interest in any tenement or lodging-house may file his name and address in the department of health. All notices and orders of the board of health required by law to be served in relation to a tenement or lodging-house shall be served by posting in some conspicuous place in the house, a copy of the notice or order, five days before the time for doing the thing in relation to which said notice or order was issued. The posting of a copy of an order or notice, in accordance with this section, shall be sufficient service upon the owner of the property affected. It shall be the duty of the board of health to cause a copy of every such notice or order to be mailed, on the same day that it is posted in the house, addressed to the name and address of each person who has filed with the department of health the notice provided for in this section.

SEC. 658. It shall be the duty of the board of health to cause a careful inspection to be made of every tenement and lodging-house at least twice in each year. And whenever the board of health has made any order concerning a tenement or lodging-house, it shall cause a reinspection to be made of the same within six days after it has been informed that the order has been obeyed. The keeper of any lodging-house, and the owner, agent of the owner, lessee and occupant of any tenement-house, and every other person having the care and management thereof, shall at all times, when required by any officer of the board of health, or by any officer upon whom any duty is conferred by this title, give him free access to such house and to every part thereof. The owner or keeper of any lodging-house, and the owner, agent of the owner, and the lessee of any tenement-house, or part thereof, shall, whenever any person in such house is sick of fever, or of any infectious, pestilential* or contagious disease, and such sickness is known to such owner, keeper, agent or lessee, give immediate notice thereof to the board of health, or to some officer of the same, and thereupon said board shall cause the same to be inspected, and may, if found necessary, cause the same to be immediately cleansed or disinfected at the expense of the owner, in such manner as they may deem necessary and effectual; and they may also cause the blankets, bedding and bedclothes used by any such sick person to be thoroughly cleansed, scoured and fumigated, or in extreme cases to be destroyed.

SEC. 659. Whenever it shall be certified to the board of health of the health department of the city of New York by the sanitary superintendent, that any building or part thereof in the city of New York is infected with contagious disease, or by reason by want of repair has become dangerous to life, or is unfit for human habitation because of defects in drainage, plumbing, ventilation, or the construction of the same, or because of the existence of a nuisance on the premises, and which is likely to cause sickness among its occupants the said board of health may issue an order requiring all persons therein to vacate such building or part thereof for the reasons to be stated therein as aforesaid. Said board shall cause said order to be affixed conspicuously in the building or part thereof, and to be personally served on the owner, lessee, agent, occupant, or any person having the charge or care thereof; if the owner, lessee or agent cannot be found in the city of New York, or do not reside therein, or evade or resist service, then said order may be served by depositing a copy thereof in the post-office in the city of New York, properly inclosed and addressed to such owner, lessee or agent at his last known place of business or residence, and prepaying the postage thereon; such building or part thereof shall within ten days after said order shall have been posted and mailed as aforesaid, or within such shorter time not less than twenty-four hours, as in said order may be specified, be vacated, but said board whenever it shall become satisfied that the danger from said building or part thereof has ceased to exist, or that said building has been repaired so as to be habitable, may revoke said order.

SEC. 661. It shall not be lawful hereafter to erect for, or convert to the purposes of, a tenement or lodging-house, a building on any lot where there is another building on the same lot, or to build, or to erect any building on any lot whereon there is already a tenement or lodging-house, unless there is a clear open space exclusively belonging thereto, and extending upward from the ground of at least ten feet between said buildings if they are one story high above the level of the ground; if they are two stories high, the distance between them shall not be less than fifteen; if they are three stories high, the distance between them shall not be less than twenty feet; and if they are more than three stories high, the distance between them shall not be less than twenty-five feet; but when thorough ventilation of such open spaces can be otherwise secured, such distances may be lessened or modified in special cases by a permit from the board of health. At the rear of every building hereafter erected for or converted to the purposes of a tenement or lodging-house on any lot, there shall be or remain a clear open space of not less than ten feet between it and the rear line of the lot. No one continuous building shall be built for or converted to the purposes of a tenement or lodging-house in the city of New York, upon an ordinary city lot, and no existing tenement or lodging-house shall be enlarged or altered, or its lot be diminished so that it shall occupy more than sixty-five per centum of the said lot, and in the same proportion if the lot be greater or less in size than twenty-five feet by one hundred feet; but this provision shall not apply to corner lots, and may be modified in other special cases by a permit from the board of health. In case of any violation of the provisions of this section, or of any failure to comply with, or of any violation of the terms and conditions of the plan for such tenement or lodging-house approved by the said board of health, or of the conditions of the permit

* So in the original.

*So in the original.

granted by the board of health for such house, or for the air, light, and ventilation of the same, any court of record, or any judge or justice thereof shall have power at any time after service of notice of violation, or of non-compliance upon the owner, builder or other person superintending the building, or converting of any such house, upon proof by affidavit of any violation or non-compliance as aforesaid, or that a plan for light and ventilation of such house has not been approved by the board of health to restrain by injunction order, in an action by the health department the further progress of any violation as aforesaid; no undertaking shall be required as a condition of granting an injunction, or by reason thereof.

SEC. 663. Every such house erected after May fourteenth, eighteen hundred and sixty-seven, or converted, shall have adequate chimneys running through every floor, with an open fire-place or grate, or place for a stove, properly connected with one of said chimneys for every family set of apartments. It shall have proper conveniences and receptacles for ashes and rubbish. It shall have Croton or other water furnished in sufficient quantity at one or more places on each floor, occupied or intended to be occupied by one or more families; and all tenement-houses shall be provided with a like supply of water by the owners thereof whenever they shall be directed so to do by the board of health. But a failure in the general supply of water by the city authorities shall not be construed to be a failure on the part of such owner provided that proper and suitable appliances to receive and distribute such water are placed in said house. Provided that the board of health shall see to it that all tenement-houses are so supplied before January first, eighteen hundred and eighty-nine. Every tenement-house shall have the floor of the cellar made water-tight; and the ceiling plastered, and when the house is located over filled-in ground, or over marshy ground, or ground on which water lies, the cellar floor shall be covered so as to effectually prevent evaporation or dampness. It shall be the duty of the board of health* that the cellars of all tenement-houses are so made or altered as to comply with this section before January first, eighteen hundred and ninety. Every such house erected after May seventh, eighteen hundred and eighty-seven, or converted shall have the halls on each floor open directly to the external air, with suitable windows, and shall have no room or other obstruction at the end, unless sufficient light or ventilation is otherwise provided for in said halls in a manner approved by the board of health.

SEC. 664. Whenever it shall be certified to the board of health by the sanitary superintendent that any tenement-house or room therein is so overcrowded that there shall be afforded less than six hundred cubic feet of air to each occupant of such building or room, the said board may, if it deem the same to be wise or necessary, issue an order requiring the number of occupants of such building or room to be reduced, so that the inmates thereof shall not exceed one person to each six hundred cubic feet of air-space in such building or room. Whenever there shall be more than eight families living in any tenement-house, in which the owner thereof does not reside, there shall be a janitor, housekeeper or some other responsible person, who shall reside in the said house, and have charge of the same, if the board of health shall so require.

SEC. 666. A tenement-house within the meaning of this title shall be taken to mean and include every house building or portion thereof which is rented, leased, let or hired out to be occupied or is occupied as the home or residence of three families or more, living independently of each other, and doing their cooking upon the premises, or by more than two families upon any floor, so living and cooking, but having a common right in the halls, stairways, yards, water-closets or privies or some of them. A lodging-house shall be taken to mean and include any house or building or portion thereof in which persons are harbored or received or lodged for hire for a single night or for less than a week at one time, or any part of which is let for any person to sleep in, for any term less than a week. A cellar shall be taken to mean and include every basement or lower story of any building or house of which one-half or more of the height from the floor to the ceiling is below the level of the street adjoining.

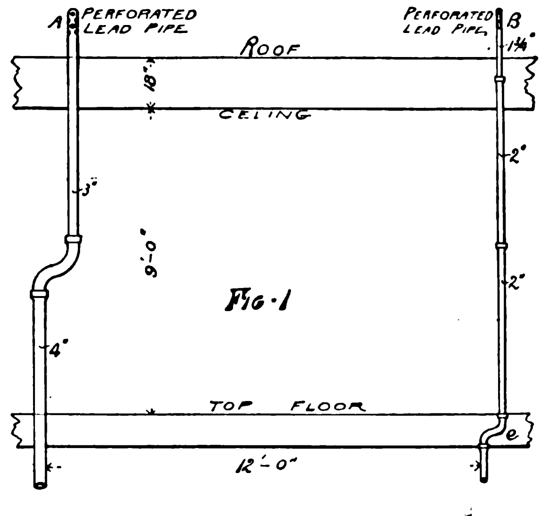
*So in the original.

DEPOSIT OF RUST IN THE BEND OF A SOIL-PIPE.

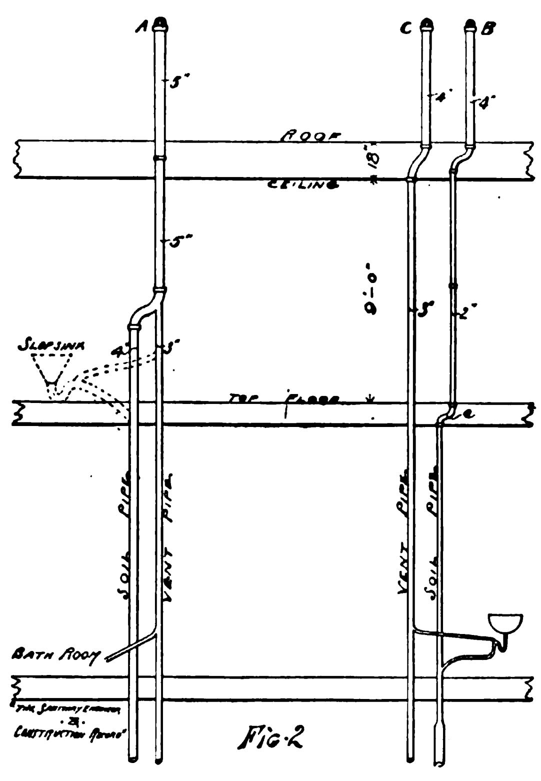
NEW YORK, April 30, 1887.

SIR: The following unusual experience which came under my notice recently is worthy of record. The drainage and plumbing of a five-story dwelling in the city was submitted for examination and revision. There were two vertical columns of "standard" iron pipe; the one marked A in Fig. 1 connecting with bath-rooms and sink on the top floors was carried by a 4-inch pipe close to the roof and there pieced out and extended above it by a 3-inch lead pipe drawn together at the top and perforated for ventilation. The column B, which was 4 inches at the base, reduced to 2 inches for the top floors, connected only with hand-basins and was also pieced out and reduced by lead pipe drawn together and perforated above the roof. There was no trap on the main drain and no ventilation of fixture-traps.

To "back-air" the traps and ventilate the drains two columns of "extra heavy" 3-inch iron pipes were put in parallel to the soil columns and all traps vented into them. The soil and back-air columns A, Fig. 2, joined near the roof and were continued by a 5-inch pipe above it. Column B, Fig. 2, was to have been similarly arranged, but it was found more convenient to carry the 2-inch soil and 3-inch vent above the roof independently, each being increased to 4 inches before passing out. The main drain was trapped at the front wall and vented to the street. Upon completing the work the smoke test was applied at the newly



inserted fresh-air inlet at the curb. Columns A and C, Fig. 2, filled at once and poured out streams of smoke, but none came from B, even after A and C were plugged up. Two pails of water poured down B showed there was a stoppage, the water rising in the pipe above the roof. The top of the column was broken out at once and cut down to a point (*e*, Figs. 1 and 2) 5 feet below where the old 2-inch pipe had been increased to 4 inches. It was then seen that in passing through the top floor an 18-inch offset had been made with quarter-bends. The horizontal internal of 2-inch pipe at this point was found completely choked for several inches with a closely compacted mass of iron-rust flakes, which had fallen from the original 10 feet of 2-inch pipe above the elbow, or from a surface of



about 5 square feet. The total amount of rust-scales taken out weighed something over a half a pound, some of the scales being as large as a dime. The pipe did not appear seriously corroded.

How long the pipe had been choked and without ventilation is not known. The stoppage being above the highest fixture did not speak for itself, nor would the peppermint test have necessarily shown it. The moral of direct lines without elbows is emphatic, and it is not improbable that many of the roof-vents in old work are now inoperative from the cause here discovered. Very truly yours,

ALBERT L. WEBSTER.

HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. IV.

(Continued from page 546.)

HEAT is applied to the boiler A, Fig. 8; the lower cross-pipe being closed. Some of the power of the heat goes to warm the water, and some of the heat is converted into motion, and raises a quantity of the water in the boiler A from the normal common level water-line C to the level D,

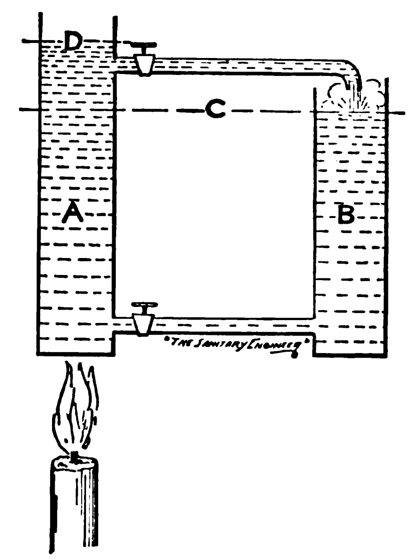


FIG. 8.

or line of equilibrium. It is in raising this water the *work* is done which causes motion, and it is the fall of this water again to its normal level which maintains the circulation.

If we let this water run over into B, as we may do by opening the cock in the upper pipe, an equal weight of cold water from the bottom of B will run into A if the lower pipe is open; but if it is not open this water, which has run through the upper pipe, will stay above the normal level C in the chamber B, and it is the fall of this water to the normal level, and not any power below it, that mantains circulation. This may be made plainer by Fig. 9. Water flows at a constant level from a reservoir R to the chamber B, thence through the bottom pipe to the chamber or boiler A, where it is warmed. There it

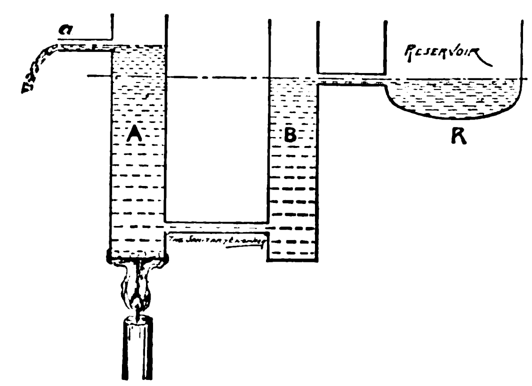


FIG. 9.

is warmed, expanded, and lifted until it flows through *a* at a much higher level than the surface of the reservoir. The question now is, was it the weight in B or the heat applied to A that caused the motion and elevation of water?

If we take an apparatus like Fig. 8, but with the cocks removed from the cross-pipes, and apply heat to the bottom at A, the water will rise in the latter until it runs over into B, and as long as heat is maintained the water will flow, and the water elevated might be just as well run into another vessel as into B, and it would so run until a quantity equal to the increment by expansion runs off.

Of course, when the pipes are open, to allow the water to move around the circuit, this rise is very small, and in a closed apparatus it is said it cannot exist, and this is adduced to try and prove Mr. Tredgold's assumption entirely erroneous, but a little thought will dispel this, as all apparatus must have an expansion-chamber, and it matters little whether it is on A or B, for when it is on the latter, and A is a closed cylinder on top, with the cock in the bottom pipe closed, the expansion simply flows through the upper pipe and rises in B to flow through the lower pipe when the latter is opened.

If we make Fig. 10 we have the simplest form of a water-circulating apparatus. A slight rise actually takes place at *d*, even with the largest pipe at *a*, the rise in the diagram being proportionally exaggerated. If there is a small pipe at *a* the water at *d* will stand higher than when the pipe is large, and the head will increase until it overcomes the friction in the pipe, and this head is the *friction head*, the equivalent of the resistance to the flow.

Perhaps, in the consideration of circulation, it is just as well to suppose the cold leg as pushing the water up within the warm leg of the apparatus. It matters little from the practical side which way we consider it, as with an apparatus, when it is completed, we are only to consider the difference of power between the rising column and the lowering column for equal perpendicular heights;

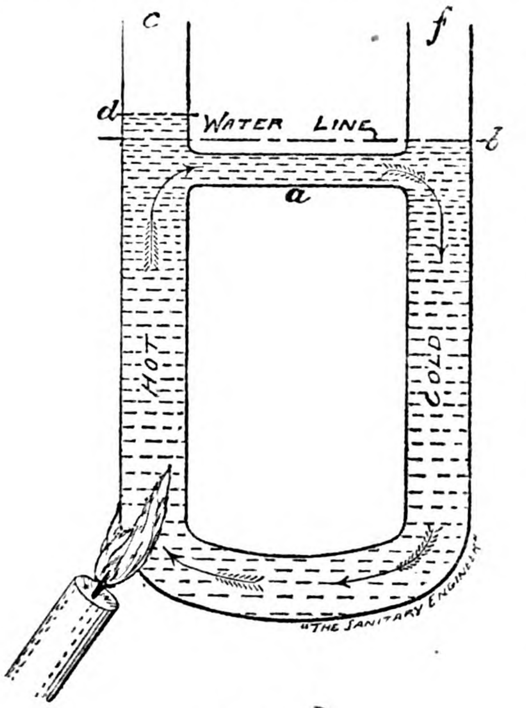


FIG. 10.

and whether this power is the lifting of water in one pipe, due to expansion, or a downward force in the other, it matters little to the fitter, as long as the result is obtained. Any force that will tend to destroy the equilibrium among the atoms of a body of water, will result in motion; though it is usual to attribute the flow to the force of gravity alone. Certainly, if the force of gravitation did not exist, there could be no circulatin or return of the current, but, on the other hand, if work was not done by heat in lifting the water, gravitation alone could not produce motion. The addition or the loss of heat destroys the equilibrium and gravitation always tends to restore it.

We may liken the whole matter to a chain over a pulley as shown in Fig. 11. If we add weight at one side at *a*, it comes down at that side and goes up at the other as shown by the arrow. If we lift it at *b* it still goes on in the same direction whether we pull down at *a* or not, and if we lift

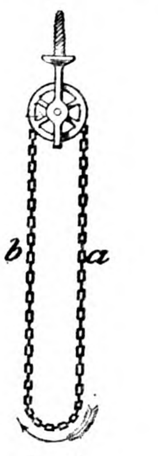


FIG. 11

and pull together it simply goes the faster in the same direction. The lifting power is figurative of the force of expansion from the boiler (heat), and the pull or weighing down is likened to the force of gravity when it becomes possible to assert itself by the loss of heat from the water.

(TO BE CONTINUED.)

STREET SCRAPINGS FOR FILLING IN BUILDING SITES.

ST. CATHARINES, ONT., April 23, 1887.

SIR: It has been customary in this place for the City Board of Works to deposit the street-scrapings inside the town where most convenient, in low places, abandoned gravel-pits, etc., and in many cases citizens have had their lots raised several feet with that material to meet street grades.

I am requested by some members of the Board of Health to inquire of THE SANITARY ENGINEER AND CONSTRUCTION RECORD if this is injurious to the health of the town, or to parties living in the vicinity of such deposits.

Please answer the above in the next number of THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

J. A. M.

[Ordinary street scrapings are a weak sort of manure, and should be used for fertilizing, not for filling. Ground which has been "made" by filling with street scrapings will not be fit to build habitations upon for many years—that is, until the organic matters are thoroughly oxidized and decomposed. Such deposits tend to pollute wells in their vicinity and to vitiate the air in houses in the immediate neighborhood. They are not always injurious to health, but there is always danger that they may become so, and, as a rule, such deposits are forbidden within the limits of municipalities.]

SYPHON OUTLET FOR A LOW SEWER DISTRICT, NORFOLK, VA.

NEWPORT, R. I., May 6, 1887.

SIR: Concerning the Norfolk syphon, I will state that the inlet of the syphon is at elevation 88.0; the outlet elevation 88.4; the crown elevation 106.6, giving a total height of syphon of 18.2 feet.

The water in the small upper well ordinarily stands at elevation 91.0, thus giving a lift of 15.6 feet. This lift varies slightly according as the large well is more or less pumped down. Yours truly, W. H. CHAPMAN.

WEIGHT OF LEAD SERVICE-PIPES.

STERLING, ILL., April, 30, 1887.

SIR: Can you explain to me, through your paper, why water departments specify that *extra strong* lead pipe shall be used in connecting with their mains when their pressure ranges from 60 to 125 pounds? Why is not *strong* pipe heavy enough to withstand the 125-pound fire-pressure?

X. Y.

[What is understood as "strong," or "A," pipe is not likely to stand the strain of the pressure indicated for a long period. If we were managing a water-works we should not permit any service to be laid of lead pipe for such pressures as is above indicated of less weight than what is here known as AAA, or one grade heavier than extra strong. A ⅝ AAA pipe weighs 3½ pounds per foot. The pipe must withstand the water-ram caused by shutting off a cock suddenly, and the pressure thus brought on services is sometimes very great and the lighter pipe cannot stand the strain.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
May 7...........	27 31	20.37	22 87	29.59	27.85	25.16	31 06

E. G. LOVE, Ph.D., *Gas Examiner.*

THE works of the Columbus, Miss., Gas-Light and Coke Company will be sold to the highest bidder on May 16, by order of the Court of Chancery.

THE gas and electric-light companies, of Chicago, have consolidated to form the Gas Trust Company, which now controls all the lighting plants in the city. It is proposed to develop electric-lighting, and several plants will be erected.

DURING March, 1887, there were exported from the United States the following quantities of petroleum products: Crude mineral oils, 4,425,609 gallons, valued at $295,708; naphthas, 485,096 gallons, at $46,263; illuminating oils, 35,491,793 gallons, at $2,783,216; lubricating and paraffine oils, 2,260,483 gallons, at $389,139; residuum, 446,124 gallons, at $20,616; grand total, 43,109,105 gallons, valued at $3,534,942, against 44,805,283 gallons valued at $3,824,394 exported in March, 1886.

THE BROOKLYN GAS BILL.

GOVERNOR HILL, in signing the bill making price of gas in Brooklyn, N. Y., $1.60 per 1,000 feet, filed the following memorandum with it:

"It would have been preferable if instead of the passage of this measure regulating the price of gas in Brooklyn by act of Legislature, there had been passed a general law providing for the creation of a State gas commission, whereby the price of gas in Brooklyn as well as in the rest of the cities of the State could be determined by a fair and impartial tribunal after an investigation of all the facts and the hearing of all the parties interested. That would have been a more satisfactory disposition of this matter. The practice of annually appealing to the Legislature in such matters should not be encouraged and the price of gas should be determined by a commission. But this measure having passed the Legislature with great unanimity, and the propriety of some reduction in Brooklyn being so clear, I have felt it incumbent on me to approve this bill. If it shall hereafter be demonstrated that injustice has been done any of the gas companies in Brooklyn, I will next year cheerfully recommend that the wrong be remedied in some shape. Having last year approved a bill fixing the price of gas to be charged in New York City, I cannot consistently withhold my approval from this measure. I trust that next year a State Commission law will be enacted, thus avoiding the necessity of further legislation of this character. The price of gas is very high in Brooklyn when compared with other large cities, and this fact has had great weight in influencing my decision on this bill. The people seem entitled to a reasonable reduction, and this bill is apparently the only relief available at the present time."

NOTES FROM CHICAGO.

(From Our Regular Correspondent.)

THE reappointment, by the new Mayor, of Health Commissioner Oscar C. DeWolf and his unanimous confirmation by the City Council are commended by the press and public, and the new Commissioner of Public Works, George B. Swift, has entered on his office with the same popular endorsement.

Almost every meeting in Chicago now gets round to the drainage and sewerage question before adjourning. The Real Estate Board, with impartiality, has just resolved in favor of the Legislature passing both the Hurd and Winston bills.

TRANSACTIONS OF THE SOCIETY OF MEDICAL OFFICERS OF HEALTH. Session, 1885-86. 135 pp., 8vo. London: Shaw & Sons. 1886.

This little volume contains several papers of interest to the practical sanitarian. The inaugural address of the President, Professor W. H. Corfield, is on the history of house sanitation, in which, after a brief account of methods of drainage and refuse disposal in ancient Rome, there is given a sketch of the development of the water-closet, and of methods of disconnecting the air of the sewers from that contained in the soil-pipes of the house.

With reference to the proposition that all houses should be certified as to their sanitary condition, he remarks that he has "good reason to fear that it would, in too many cases, lead to a false sense of security, and in the end do more harm than good. It would, no doubt, lead, for the time being, to a great amount of so-called sanitary inspection and surveying, and would give those who are engaged in these matters a great deal to do; but I doubt if much of the work done, or the way in which it would be done, would be in the end satisfactory. * * * In these, as in many other matters, grandmotherly legislation should be avoided as much as legislation in a panic."

Dr. G. A. Heron contributes a paper on the cholera bacillus of Koch, in which he takes the ground that Koch has fairly demonstrated the existence and general characters of a specific cholera bacillus, and that it is wise to base preventive measures upon this theory.

One of the most interesting papers in the volume is the one by Dr. Horace Swete, "On suction of sewer-gases into service-pipes conveying drinking water, a fertile causation of typhoid fever." Dr. Swete gives a summary of the various reports heretofore published on this subject, and then refers to cases at Droitwich and at Kidderminster, which came under his personal observation, in which such contamination of the drinking-water seems to have occurred. The remedy which he proposes is a special form of valve arranged to admit air into the highest point of house service pipes and sections of street-mains whenever the water-supply is turned off.

Other papers of interest are: "On the Protection of Milk from contamination, and the measures necessary for maintaining the purity of milk supplied to the metropolis and other towns," by Dr. A. Wynter Blyth and Mr. Alfred Spencer; on "The Sanitary Condition of Poor Districts in the Metropolis, with especial reference to their water-

closet accommodation," by Dr. Louis Parkes; on "Dr. Koch's Gelatine-peptone Water-test," by Professor G. Bischof; and on "The Recommendation of the Royal Commission on the housing of the working classes as affecting the status of the Medical Officer of Health," by Dr. Edward Seaton.

While some of these relate more especially to local regulations and local interests, yet the problems of sanitary officials are everywhere fundamentally the same, and these papers by trained health officers should be studied by our own sanitarians, to whom we commend this volume.

ANNUAL REPORT OF THE HEALTH DEPARTMENT OF THE CITY OF BALTIMORE.

THE Secretary of the Board, in the report for 1886, estimates the population of Baltimore as, white, 355,770; colored, 61,450; total, 417,220. This estimate is based on a police census, and is probably too high. On this basis the death-rates of the city for the year are, for the whites 18.20, for the colored 30.52, or for the aggregate 19.98 per 1,000. Of 8,339 deaths reported 1,182 were from consumption, 631 from pneumonia, 190 from diphtheria, 201 from measles, and 150 from typhoid fever.

The were 3,565 deaths of children under five years of age, being 42.75 per cent. of the total mortality.

The Commissioner of Health, Dr. Steuart, states that during the year there has been the usual struggle to lessen the nuisance of bad odors arising from the city sewers. "Irregular in size, insufficient in grade, and with the older ones faulty in material and construction, it has been possible to do no more than to remove the filth and disinfect."

He recommends cremation as the best means of disposing of garbage and offal, but is not yet prepared to recommend any special form of apparatus for that purpose. The amount of garbage collected during the year was 33,849 cartloads. The amount of night-soil removed during the year was 52,810 loads, or 10,562,100 gallons.

The Assistant Commissioner, Dr. McShane, calls attentention to an overcrowded school-house in which the privies are within six feet of the rear windows of the lower class-rooms, and very offensive; no cellar; sub-floor very wet; water oozing through front walls, etc. He remarks also that the plumbing of the City Hall is in bad condition.

The Inspector of Plumbing, Mr. John W. Lee, reports 2,029 inspections of plumbing made during the year. The number of permits granted for plumbing plans was, for new houses, 563; for old buildings, 568.

The expenditures of the Health Department during the year amounted to $78,582.03.

TALL CHIMNEYS AND LIGHTNING CONDUCTORS.

AT the last meeting of the *Société des Ingénieurs Civils* M. Debar gave a very graphic description of a case in which a tall chimney unprovided with a lightning conductor had been suddenly destroyed by a sort of spontaneous outburst of atmospheric electricity. The occurrence certainly seems to have been one of a very remarkable character. At Fécamp, a village on the French coast, the weather being perfectly calm, no wind, a smooth sea, about 10:30 P. M. on the night of the 9th of January, M. Debar was standing at a short distance from the chimney of a factory, which rose to a height of 30 metres, when suddenly a vivid blaze of light flashed forth, a tremendous explosion was heard, and the chimney was seen literally to burst asunder at a point about six metres from the base, the fragments being thrown in all directions, inflicting great damage upon the building within a radius of 100 metres. The place looked as if it had suffered from a severe bombardment; happily no personal injury was sustained. Large quantities of the bricks seem to have been completely pulverized, and the ground was covered with brick-dust for a distance in one direction of more than 400 metres. We are much suprised to find that M. Debar, after stating that there were many tall chimney in this district unprovided with lightning conductors, expressed the opinion that the effect would have been equally disastrous in any case, as no conductor could possibly have proved a channel for the safe passage of such a terrific discharge. This might easily be true, but surely M. Debar is aware that the function of a lightning conductor is chiefly to avert the attainment of such tremendous difference of potential as is here indicated. In the present state of our knowledge, the moral of the catastrophe is certainly not that a lightning conductor would have been unavailing, but rather that the owners of the factory have been guilty of the most culpable negligence.—*Electrician.*

ATLAS OF NEW JERSEY.

SHEET No. 5, recording the topographical features of portions of Mercer, Somerset, and Hunterdon counties, has been issued, and shows the same careful work that has characterized all the previously issued maps.

ENGINEERS' CLUB OF PHILADELPHIA.

AT the April 16 meeting, President T. M. Cleemann in the chair, twenty-four members were present. The Secretary presented some notes from Mr. Edwin Ludlow on the "Preparation of Anthracite Coal." The notes were suggestions to inventors to produce a single dry jig that would stand a test of actual trial. He stated that "not to be too cumbersome, a single jig should not have a greater capacity than 500 tons per day, and as the shipping capacity of the anthracite region is about 200,000 tons per day, it would take about 400 to supply the trade."

Mr. J. E. Codman presented a description of a "Perpetual Motion Machine," which had been offered by a Western correspondent of the Philadelphia Water Department, as a means of supplying Philadelphia with water at an annual running expense of five dollars.

ENGINEERS' CLUB OF ST. LOUIS.

THE club met May 4, President Potter in the chair, and twelve members present. Colonel E. D. Meier read a paper on "Evaporative Efficiency of Boilers," asking that the present paper be considered as introductory to a more complete discussion, which he hoped to be able to present later. He spoke of the duty expected of steam-generating apparatus, and the difficulties met with in reducing the results secured in tests to a common standard for comparison. Some suggestions were made looking toward a suitable standard of comparison. The values of various grades of fuels were touched upon. The relative merits of steel and iron for boiler construction were discussed, the conclusion being that the matter depended wholly upon proper precautions being taken to make sure that a suitable grade of material is secured. Professor Potter, Professor Johnson, Mr. Flad, Mr. Seddon, and Mr. Wheeler took part in the discussion.

The president announced the Committee on Smoke Prevention as now constituted to be: W. B. Potter, E. D. Meier, H. B. Gale, C. F. White, W. H. Bryan, and C. E. Jones. A paper by H. A. Wheeler on the "Relative Economy of Machine and Hand Drilling" was announced for the next meeting.

WORCESTER SOCIETY OF ENGINEERS.

THE Worcester County Society of Engineers' last meeting was devoted to a discussion of the report of City Engineer Allen, on the "Disposal of the Sewage of Worcester," the meeting passing the following resolution:

"*Resolved*, That the Worcester County Society of Engineers hereby express their appreciation of the study and labor shown in the report on sewage by City Engineer Allen, and that in their opinion it is one of the ablest and most exhaustive essays yet offered on this subject."

SUBJECTS for the theses of the candidates for the degree of Bachelor of Science in the civil engineering course of the Massachusetts Institute of Technology are as follows: "Fine Grinding of Cements," William C. Cushing and Walter S. Thompson; "Sewerage of Brockton," Henry F Bryant; "Economic Arrangement of the Kinzua Viaduct and Design for a Different Arrangement," William A. Whitney and James A. Stanwood; "Review of the New York Water-Supply and Quaker Bridge Dam," William B. Blake; "Location of a Narrow-Gauge Railway from the Davis Mine to Claremont, Mass.," Frederick Thompson and Frank G. Burgess; "Location of a Railroad from Medford to Stoneham to Connect with the Boston and Lowell or the Boston and Maine Railroads," Sidney Williams.

EFFECTS OF FOUL AIR.

IN his annual report as Medical Officer of Health of the River Tyne Port Sanitary Authority for 1886, Dr. H. E. Armstrong mentions that in February the Indian steamship "Nederlands en Oranje," from Bombay via Odessa, with seventy-three hands, came in for repairs. Three of the crew were reported to have died at sea from the inhalation of the fumes from charcoal burnt in their forecastle during the cold weather, from which all of the crew suffered severely, both before and after arrival in the Tyne. Three of the men died in this port from uræmia and dropsy, the result of paralysis of the kidneys, and two others who were sent to the Newcastle infirmary suffering from the same illness, of whom one died. The warming of the 'tween-decks (which were large) with steam-coils, and the removal there of the crew who were exceedingly depressed and melancholy, was advised and effected. This led to a cessation of cases of illness and a marked improvement in the general condition of the men.

MR. EDWARD H. KENDALL, of this city, Vice-President of the American Institute of Architects, and Mr. Daniel Huntington, President of the National Academy of Design, have given to the Secretary of the Department of Parks opinions favorable to the statue of Garibaldi, which the Italian societies wish to be placed in Central Park.

PERSONAL.

MR. FRANCIS COLLINGWOOD has accepted the position of Chief Engineer of the Chesapeake Dry Dock and Construction Company, at Newport News, Va. His office address will be as heretofore, 82 Fulton Street, New York.

MR. GEORGE RICE, of Philadelphia, has been appointed Constructing Engineer of the Pittsburg Traction Company.

MR. DAVID HUNTER has been reappointed Superintendent of Gas in the city of Allegheny, Pa.

SECRETARY ENDICOTT, of the Navy, Architect Clark, of the United States Capitol, Senator Hoar, and Mr. A. St. Gaudens, sculptor, of New York City, and Richard M. Hunt, architect, also of New York City, are a committee to select a design for the statue of Lafayette from among those submitted by foreign and American sculptors.

J. D. COOK, of Toledo, so long and favorably known as a prominent and hydraulic engineer, has associated with himself Mr. L. E. Chapin, a graduate of Michigan University, who for some years past has been connected with the City Engineer's office of Toledo. Hereafter it is proposed to include the sewerage of towns and cities in the scope of the professional efforts of the new firm.

MAYOR HEWITT has made the following appointments to the departments of this city: Department of Public Parks, Waldo Hutchins, for the unexpired term of Henry R. Beekman, and Theodore W. Myers, in place of Jesse W. Powers, whose term expired May 1. Department of Docks, Charles H. Marshall, to succeed Joseph Koch, whose term expired May 1.

PROFESSOR S. P. LANGLEY, of the University of Western Pennsylvania, has been elected Secretary of the Smithsonian Institution, of Washington, D. C.

MR. A. J. BLOOR, an architect of this city and Secretary of the American Institute of Architects, is in correspondence with architects and associations from all parts of the world who wish information in regard to the American Institute of Architects and also in regard to the building laws in American cities. Many applications for membership are also received.

MR. M. F. CUMMINGS, architect, of Troy, N. Y., has been appointed Superintendent of Construction of the Government building in that city.

COLONEL GEORGE E. WARING, JR., has gone to California to superintend the work there in connection with the water-supply.

MR. HIRAM A. HITCHCOCK has been appointed Associate Professor of Civil Engineering in the Thayer School of Engineering, at Hanover, N. H.

MESSRS. I. V. BAKER and William E. Rogers have been nominated by the Governor and confirmed by the Senate to be Railroad Commissioners in this State.

MR. CHARLES PUGSLEY, Chief Assistant Engineer to the Croton Aqueduct Commission, has resigned on account of ill health.

MESSRS. NEWTON, Dowd and Barnes, of the Croton Aqueduct Commission have been appointed a committee to select an engineer for the recently created Deputy Chief Engineership.

A BOARD of Officers, consisting of Colonel John C. Tidball, First Artillery; Lieutenant-Colonel Peter C. Haines, Corps of Engineers, and Major Lawrence S. Babbitt, Ordnance Department, has been appointed to meet at Fortress Monroe, Va., for the purpose of making a division of the land of that post with a view to consolidating, separately, the belongings of the Engineer Corps and the Ordnance Department.

MAJOR MORSE K. TAYLOR, Surgeon U. S. A., will retire May 14, on account of age.

A PRIZE of $50 has been established in the Department of Architecture of Princeton College, by Mrs. Norman White, of New York City.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

PROPOSALS.

TOO LATE FOR CLASSIFICATION.

PROPOSALS, addressed to the Boston Water Board, and indorsed, "Proposals for Mason's and Carpenter's Work for the Fisher Hill Gate-House," will be received at the office of the Boston Water Board, City Hall, Boston, until May 19 1887. H. T. Rockwell, Chairman Boston Water Board.

FURNISHING 5,000 cubic yards of stone ballast, 4,000 cubic yards crushed stone. Until May 18. Address John W. McDonald, Superintendent of Streets, Boston, Mass.

MASONS' work on the Horace Mann school-house in Boston. Until May 23. Address A. H. Vinal, City Architect, Boston, Mass.

DREDGING and embankment on Potomac River. Until May 28. Address Colonel Peter C. Hains, United States Engineer, Washington, D. C.

FURNISHING stone for Wilmington Harbor, Cal. Until May 31. Address Major W. H. H. Benyaurd, U. S. A., 533 Kearney Street, San Francisco.

TRADE CATALOGUES.

POND ENGINEERING COMPANY, engineers and contractors, St. Louis, Mo., have issued an illustrated catalogue for 1887, which illustrates and describes improved steam and hydraulic machinery.

COMPETITIVE PLANS IN CINCINNATI.

THE date of closing the competition for architects' plans for the proposed City Hall at Cincinnati has been extended from June 1 to July 1.

NEW BUILDINGS IN ST. PAUL.

(From our Special Correspondent.)

ST. PAUL, May 2, 1887.—A recent visit of your correspondent among the principal architects shows the building outlook for this season unusually good. The first four months show an increase of over $900,000 over 1886, as per the building inspector's books. In addition to buildings enumerated in a former article, I note the following:

By Architect J. W. Stevens—A residence for Mrs. B. W. Davidson, on Summit Avenue near Mackubin, to cost $20,000; blocks for N. R. Frost, on Western Avenue, at $7,500 and on Fourth Street, at $8,000; residence for S. B. Gault, on Holly Avenue, $10,000; for F. D. Hager on Virginia Avenue, $15,000; for Nathan Ford, on Dayton Avenue, $10,000. He is also planning houses for North St. Paul, a new suburban town to cost $125,000, all told, including hotels, business blocks, and residences.

By Architect E. S. Radcliffe—He has now under consideration propositions for three different blocks, one to cost $60,000, five stories high; one to cost $20,000, four stories high; one to cost over $100,000, seven or eight stories high. In addition he has residences under way as follows: F. J. Schultz on Grant Street, to cost $16,000; one for Thomas Riley, on Laurel Avenue, to cost $12,000, and one for W. B. Banks to cost about $10,000. He is also preparing plans for a block of ten tenements for Mr. Banks to cost $30,000, and a block of stores at Merriam Park to cost $12,000, to be owned by Chamberlain & Bernard.

By architects Hodgson & Stern—For E. Felderhauser this firm has prepared plans for fifteen houses at the corner of Marshall and Arundel, built of brick, stone, and terra-cotta, with tile roofs. The court formed by the houses will be fitted up as a park. A central plant will furnish steam-heating and electric-lighting. The total cost will be $135,000. Three houses are to be built for the same party on Nelson Avenue at $15,000. In addition to the above this firm has on hand a residence for J. R. McMurran, at St. Anthony Park, $25,000; tenement-houses for J. P. Gribben and J. J. Watson, $20,000; a block for J. R. McMurran, at $25,000; the Como Hotel and Club House, $25,000; four houses for McClung & McMurran on Langford and Breda Avenues, $20,000; residences for J. J. McCardy, at Dayton and Kent, $8,000; for H. P. Rugg, on Summit, between Selby and Nina, $30,000; for A. B. Wilgus, $8,000, West St. Paul.

By architects Hamilton, Zschocke & Turner—Block of stores and flats Concord Street, for W. Berlandi, $20,000; German Catholic Church, Robie and Hall, $16,500; block of three houses on Exchange Street for W. Barteau, $15,000; warehouse for Griggs Bros., on Fillmore Avenue $12,000; double store building for Whitwell Bros. on Ducas Street, $12,000; three-story double stores and flats for Mr. Highhouse on Dakota, $13,500; residence on St. Anthony Hill, cost, $15,000.

By architects Wilcox and Johnston—The central building of Macalester College, Summit and Snelling Avenues, to cost $35,000; additions to the city and county hospital, two pavilions fronting Jefferson boulevard, of brick and stone, $50,000; additions to Van Buren School, eight rooms, $29,500. Residences: George C. Stone, Central Park, brick and brownstone; cost $27,000. Messrs. Bement and Cary, Central Park, brick and brownstone; cost $18,000. R. B. Wheeler, corner Avon and Summit Avenue. Mrs. Campbell, corner Prospect and Vine Streets, frame; cost $8,000. G. O. Nettleton, Pleasant Avenue, frame; cost $8,500. Block of residences for William C. Riley, brick and brownstone, corner Nina and Laurel Avenues; cost $60,000. Block of residences for Dr. Wharton, Tenth Street, near Jackson, brick and stone; cost $20,000. This firm also has the plans under way for "The Aberdeen," an apartment building to be erected by J. J. Watson, at the corner of Dayton and Virginia Avenues. It will be seven stories, of red sandstone and brick. The roof will be tiled and fitted up with promenade. The cost will be over $100,000.

NEW ENGLAND WATER-WORKS ASSOCIATION.

THE annual meeting of the New England Water-Works association will be held at Manchester, N. H., June 15, 16, and 17. The full programme will be published in due time.

AMERICAN WATER-WORKS ASSOCIATION.

THE annual meeting will be held in Minneapolis July 13, 14, and 15. Messrs. J. H. Henion, A. Rinkers, J. T. Fanning, of Minneapolis, and L. W. Rundlett, of St. Paul, and H. H. Harrison, of Stillwater, are the Committee of Arrangements.

CONTRACTING INTELLIGENCE

WATER, SEWERAGE, ETC.

DECATUR, ALA.—Articles of agreement have been entered into between the Mayor and Councilmen of the town of Decatur and the Decatur Land Improvement and Furnace Company on last meeting of the Council, April 28, and the Decatur Land Improvement and Furnace Company will establish water-works, as per their agreement. The contract has been let to Inman Bros., of New York.

GLENWOOD SPRINGS, COLO.—W. M. Taylor will answer all inquiries in regard to the new water-works for Glenwood Springs.

AMSTERDAM, N. Y.—The superintendent of the water-works recommends that a storage reservoir be built, the water-mains extended, and water-meters be purchased and placed in hotels, boarding-houses and livery stables.

CLEVELAND, TENN.—It is now again proposed to have a water-supply, Rohta Spring to be the source.

BETHLEHEM, PA.—South Gas and Water Company will extend its mains considerably this summer.

GREENWICH, N. Y.—The Water-Works Company will construct a reservoir on the Andrew Hay farm.

JAMESTOWN, DAK., wants bids until May 23, for sinking an artesian well at the North Dakota Hospital grounds. Address F. E. Jones, secretary of the hospital trustees.

MANSFIELD, MASS., at a town meeting May 4, voted against accepting the act of the State Legislature granting authority to introduce a water-supply. Another meeting will be held soon, however, and it is expected the town will then accept the act.

SAN DIEGO, CAL.—It is proposed to raise the Sweetwater dam to a height of 80 feet. The reservoir will then contain about 800,000,000 gallons of water. The cost will be about $1,000,000.

SING SING, N. Y.—The new water company has organized and elected John P. Truesdell, President; S. M. Sherwood, Secretary, and Isaac B. Noxon, Treasurer.

SPENCER, MASS.—A bill is now before the State Legislature which incorporates the Spencer Water Company.

GALLATIN, TENN., will have water-works.

BESSEMER, ALA.—The Bessemer Land Improvement Company will build water-works.

ASHLAND, KY.—The New Jersey Land and Water Utility Company has been organized.

HUBBARD CITY, TEX.—An artesian well will be sunk here by J. H. Lippard.

CRESCENT CITY, FLA.—Water-works projectors should look into the movement here to provide a water-supply, taking Lake Stella as the source.

SAN DIEGO, CAL.—The company which will build the flume to bring water from the headwaters of San Diego River to this city will push the work. The contract for grading the line of the flume has been given to Moore & Co., of San Francisco. The water will be used for irrigation and domestic supply.

MARBLEHEAD, MASS.—The contract for the construction of water-works has been awarded to J. F. Longford, of Newton, at $42,000. They are to be finished by July 1.

FORT SCOTT, KANSAS.—H. C. Comegys, of New York City, of Comegys & Lewis, is at the head of a syndicate to purchase the water-works. The matter will be settled May 16, when the transfer to the new owners will be made. The price was $100,000.

WATERVILLE, ME., will have water-works as announced. The company and the town have come to an agreement. The conditions of the contract are that the company will supply the town with 50 hydrants for $2,000 per year; additional hydrants, $30 each; contract to last 20 years, with option to the town to continue it afterwards.

CAPE ELIZABETH, ME.—A town meeting will soon act on the proposition of the Portland Water Company to furnish a supply of water. If a contract is made the company will expend $50,000 for water-pipe, hydrants, laying, and other work. The town will pay the company $2,000 annually.

PORTLAND, ME.—The Portland Water Company contemplates increasing the capacity of the reservoir from 15,000,000 to 20,000,000 gallons.

PLAINFIELD, N. J.—C. P. Bassett, C. E., of Newark, has reported to the City Council, giving the cost of alternate plans for sewers and water-supply. For sewerage with disposal of 30 acres of land, $118,800. With outfall in the Raritan River, including five miles of mains, $173,800. Both plans include 17 miles of pipe-sewers 8 to 20 inch, with flush-tanks, manholes, etc. The disposal on the land is recommended, with supplementary chemical precipitation, when the increase of population requires it.

For water-supply, including 18 miles of distributing pipes, 6 to 12 inch, with wells, pumps, boilers, engine-house and stand-pipe, $126,990. Supply from Green Brook, by gravity, including reservoir and 16 inch conduit, $208,390. Supply from Stony Brook, by gravity, including reservoir and 16-inch conduit, $163,290. The system with wells, stand-pipe, and pumping machinery was recommended.

ALTOONA, PA., has issued proposals for repairs to Prospect Hill reservoir.

AMSTERDAM, N. Y.—The city will build 16 miles of sewers as soon as practicable, mostly through rock; particulars may be found in our Proposal Columns. William B. Landreth is the constructing engineer.

ALBION, N. Y., will have a water-supply by Bassett Bros., of Buffalo. There will be 80 hydrants at an annual rental of $3,000.

PINE BLUFF, ARK.—Water-works will be erected here by the St. Louis Light and Power Company, at a cost of $15,000.

BENTON, MONTANA, will have water-works to cost $155,000.

TEKAMAH, NEB., will have water-works to cost $55,000.

MANSFIELD, MASS.—At a town meeting, May 4, to decide on putting in water-works, there were 100 votes for and 64 against. As two-thirds were required to carry the proposition, it was lost. The Moderator was W. A. Copeland.

BEAUMONT, TEX., will have water-works.

HERKIMER, N. Y.—John Lockwood, of New York City and Seneca Falls, has made a proposition to the Village Trustees in regard to water-works. He proposes to obtain the supply from wells, the quantity to be 1,000,000 gallons daily. He will erect all the necessary works, provided the village will take a sufficient number of hydrants at $40 per annum each.

EUREKA, KAN., will have water-works.

LANCASTER, PA.—The authorities of Lancaster have received two preliminary reports on the matter of their water-supply, one from J. J. R. Croes, of New York, and one from Charles D. Darrach, for Wilson Brothers & Co., of Philadelphia. Mr. Croes proposed two plans, one retaining the pumping-station where it now is, and laying a 36-inch iron main to a point on the creek above the railroad bridge; the other moving the station above the bridge. The estimates of cost were as follows:

Retaining present pumping-works:

Lay 36-inch wrought-iron supply main from above railroad bridge to the present works..	$60,000
Annual extra cost of coal capitalized	13,275
Total	$73,275

Moving pumping-works to point above railroad bridge:

Build new dam, pump-well and engine-house..	$30,000
Build one new pumping-engine and remove present engines to new site................	35,000
Lay 36-inch cast-iron force-main to reservoir..	30,000
Annual extra cost of steam-pumping capitalized....................................	38,800
Total	$133,800

Mr. Croes prefers that further investigation be made before passing on the question of filtration.

Mr. Darrach, in his preliminary report, states that on a superficial examination he is of the opinion that it would be more costly to carry the sewage from above the works to a point below them, than it would be to remove the water works to a point above contamination. He suggests a storage and subsiding basin at the point indicated, contemplating a supply of three million gallons, and also suggests a 24-inch main should be laid, and the system of continuous pumping discontinued. He gives no estimate of probable cost.

KEOKUK, IOWA, City Council is considering the purchase of the water-works.

YANKTON, DAK., will soon take up the question of extending the water-supply. The source will be artesian wells.

LANCASTER, PA.—The authorities here are looking into the matter of water filtration for the city supply.

MICHIGAN CITY, IND., has awarded a contract for water-pipe to Dennis Long & Co., at $3,000. Proposals for pumping engines will be readvertised.

FRANKLIN, IND.—A city election will be held to decide on water-works.

WATER COMPANY.—Incorporated is the Saranac Lake Water Company in this State. The incorporators all live in Harrietstown. Orlando Blood is one.

SHARPSBURG, PA.—See our Proposal Column for proposals for water-pipe.

CONESUS, N. Y.—The question of providing a supply of water for this town is under discussion.

AUGUSTA, ME., Water Company will lay 21,000 feet of water-pipe to supply the "Home" at Tagus.

OSWEGO, KAN., has contracted for a system of sewers.

ORGANIZED is the Mechanicstown, Md., Water Company, with Van B. Oster, President.

BRANTFORD, ONT., wants water-works.

EASTPORT, ME., will have water-works; to be built by M. Talcott.

ROUND LAKE, N. Y.—Two reservoirs of 70,000 gallons each are being built to supply water to the railroad.

COHOES, N. Y., Water Board has ordered 6,000 feet of new water-pipe.

SHARPSBURG, PA., wants water-pipe. See our Proposal Column.

TORONTO, ONT.—The Water-Works Department estimates for the present year are in part as follows: Maintenance, $10,100; engine house, $66,940. It is proposed to expend on capital account this year $100,000 for mains, service and meters; $13,000 for store house, etc., and $2,000 on the water by gravitation scheme survey.

ST. CLOUD, MINN.—H. D. Upton has submitted a proposition to the City Council to purchase the city water-works and extend them.

WEEPING WATER, NEB.—The city authorities are ready to receive propositions for a franchise for water-works suitable for a village of 1,500 inhabitants. The assessed valuation of the town is about $140,000, and the town is in a valley where the works can be comparatively cheaply constructed. The railroad company has promised to take water. For further information address J. F. Travis, clerk of the board.

GAS, STEAM, BUILDINGS, ETC.

SAN ANTONIO, TEX.—At a city election April 30, the proposition to raise $150,000 of bonds for a city hall and other improvements was carried.

NEWTON, MASS., has contracted with the Newton Gas Company for 700 gas-lights at $15 per annum, and 490 oil-lights at $10.50 per annum.

LANCASTER, PA.—The American District Steam Company will erect a plant and lay mains for a general steam-supply on the Holly system. Dr. R. S. Bishop is president.

ONEIDA, N. Y.—Bids have been received for electric-lamps for street-lighting as follows: J. W. Warner, whose bid was accepted, offered to furnish 41 electric-lights for 300 nights in the year for $1,999.99, and $49.51⅛ for each light over 41. The American Illuminating Company offered to furnish 41 electric-lights and 25 gasoline lamps for $2,950, or without the gasoline-lamps for $2,400.

CUMMINSVILLE, O.—Organized is the Northside Natural-Gas and Oil Company. John H. McMakin is interested.

MACON, GEO., will have a new gas company, with Jessee W. Starr, of Philadelphia, Pa., at the head of it.

PIPE LINE.—It is reported that the Standard Oil Company is preparing to pipe oil from the Ohio fields to Toledo. The cost is put in the millions. Pipe manufacturers should look into this.

RAILROADS, BRIDGES, CANALS.

LITTLE ROCK.—The Southern Oil Company have let contracts for an immense cotton-seed oil mill, to be erected in the east end of the town, near the State Fair Grounds. About $150,000 will invested. Noah Hamlet has the contract for the brick-work, and the Smith-Vaile plant will be used.

ASBURY PARK, N. J., has granted a franchise for an electric railway on the Taft system. The road pays a yearly rental of $3,000.

MILWAUKEE.—The People's Street-Car Line will build tracks on First Avenue and over the viaduct up Sixth Street to the north-western part of the city.

NORFOLK, VA., is considering the expediency of raising $100,000 for street pavements.

SCHOHARIE, N. Y.—The village has decided at special election to build two iron bridges over Schoharie Creek.

BRIDGES.—The contract for building three iron bridges on the Anniston and Cincinnati Railroad has been given to the Atlanta, Geo., Bridge-Works.

MONTREAL, QUE., has under consideration extensive changes in the grades of streets, to obviate trouble from flooding. G. W. Stephens has prepared a scheme for doing the work.

TORONTO, ONT.—A proposition to give $100,000 to Dominion Government to improve the harbor will be voted on at a special city election.

SARATOGA, N. Y.—The contract for the Church Street sewer and water-conduit has been awarded to Adam Miller at $7,288.

TUNNELS.—Work on the Hudson River tunnel, between this city and Hoboken, is resumed. D. C. Haskins is the projector.

RAILROAD.—The Delaware Railroad Company, recently incorporated in this State, has elected Thomas Cornell, of Kingston, N. Y., president. Work will be begun at once.

BROOKLYN.—The Kings County Elevated Railroad will soon build the extension of its structure in Fulton Street from the ferry to Boerum Place.

BROOKLYN.—The bridge terminus will be extended to Concord Street. The right of way will be bought and the work begun as soon as possible.

INCORPORATED, May 2, at Springfield, O., was the Massillon Bridge Company, with a capital of $75,000.

TORONTO, CAN.—It is proposed to construct a subway here for the Toronto, Grey and Bruce Railway.

CABLE ROAD.—The Pittsburg Traction Company has decided to let contracts for constructing the road about the 15th of this month. George W. Elkins is President, and Joshua Rhodes is Secretary.

NORRISTOWN, PA.—Engineer A. W. Carson has made an estimate of cost for a bridge over Saw Mill Run at Airy Street, putting it at $10,000.

INCORPORATED is the Metropolitan and Suburban Railroad Company, of St. Paul, Minn. Maurice Auerbach, Albert Scheffer, L. H. Maxfield and others are incorporators.

ELEVATED RAILROADS.—On Thursday last the Rapid Transit Commissioners of this city laid out extensions of the elevated system, beginning at Battery Place and extending up West Street and west side streets to connect with the Ninth Avenue road at Amity Street, a distance of about two miles.

ST. PAUL. — The County Commissioners have appropriated $9,600 for roads and bridges in Ramsey County.

BIDS OPENED.

WALTON, N. Y.—The Canton Bridge Company has secured the contract for building the iron bridge at Bridge Street over the river at $9,000.

FORT PLAIN, N. Y.—Dean & Westbrook, of New York, have the contract for building an iron bridge across the Mohawk River at this place at $34,500. It will be a single span, with 325 feet between abutments, and the roadway will be 20 feet wide.

BATAVIA, O.—Bids for constructing the superstructure of the Stone Lick bridge have been received by the County Commissioners as follows: L. A. Wysong, for Champion Bridge Co., Wilmington, $4,480: John Helton, Wrought-Iron Bridge Co., Canton, $4,625; J. C. Morrison, Columbia Bridge Co., Dayton, $4,640; G. P. Anawalt, Mt. Vernon Bridge Co., $4,664; V. Morris, King Iron Bridge Co., Cleveland, $4,680; James A. Huston, Smith's Bridge Co., Toledo, $4,747; F. J. P. Brackett, Lomas Forge and Bridge Co., Cincinnati, $4,760; H. E. Beecher, Morse Bridge Co., Youngstown, $4,844.80; E. G. Penn, Columbus Bridge Co, $4,832; W. B. Bassett, Pittsburg Bridge Co., $5,120.

CINCINNATI, O.—At the opening of bids, May 5, for furnishing a pumping-engine equal to the delivery of 25,000,000 gallons daily from the Ohio River to Eden Reservoir, only one set was received—viz., from Henry R. Worthington of New York City. This firm submitted four bids as follows: A, duty 65,000,000; time required, 10 months, $100,000; B, duty 65,000,000, 10 months, $119,000; C, duty 100,000,000, 10 to 12 months, $138,000; D, duty 100,000,000, 10 to 12 months, $163,000. In each case the capacity was 25,000,000 gallons daily. The B bid, at $119,000, was accepted.

PITTSBURG, PA.—The contract for laying about 43,000 lineal feet of water-pipe has been given to Eugene Scanlon at 24¾ cents per foot. The sizes are 12, 10, 8, 6, and 4 inch.

MILWAUKEE, WIS.—The Board of Public Works opened bids May 3, for laying water-mains in streets of the city. The bids were for laying 6, 8, 12, 16 and 20 inch pipes, and were as follows: G. H. Sullivan, 24½, 32, 46, 62, and 85 cents; J. J. Crilley, 23, 29½, 46, 65, and 80 cents; William Forrestal, 23, 27¼, 42, 59, and 78½ cents; R. Chambers, 22½, 30, 41, 58, and 84 cents; Thomas Morrisey and D. O'Driscoll, 23½, 27½, 75, $1.10, and $1.20. William Forrestal will be awarded the contract for laying the 8, 12, and 20 inch pipes, and R. Chambers the 6 and 16 inch pipes.

The contract for laying house-drains has been let to Charles Polachek at 60 cents per lineal foot on Third and Sycamore Streets. The contract for water-pipes on same streets was let to R. J. Finn at 67 cents per lineal foot for the long side, and $1.09 per foot for short side.

NEW YORK CITY.—Bids were opened at the Department of Docks on Wednesday, for dredging in the following named places on the East River: Half slip west of Pier 19, Pier 43, east side, Pier, 44, west side, bulkhead between Pier 43 and 44. The engineer's total estimate of the quantity of material necessary to be dredged was 16,200 cubic yards. The bidders were: A. M. Tebo, New York, 23 cents per cubic yard; Morris Dredging Company, New York, 23½ cents per cubic yard. As there was an informality in the bids no award was made, but an examination will be made by the Commissioner.

SANDUSKY, O.—Contracts for buildings for the Ohio Soldier's Home near this city, aggregating $150,000, were awarded May 6 by the Board of Trustees: Dawson & Anderson, of Toledo, get five cottages for $53,000; Doerzbach & Decker, of Sandusky, get the other buildings for $37,000; Kelly & Jones Co., of Pittsburg, get the steam-heating for $31,000; the Sandusky Gas Co. get the plumbing, gas-fitting, and sewers for $19,000. This work is to be done by January, 1888.

ROCHESTER, N. Y.—Bids for cast-iron water-pipe and specials were received by the Executive Board May 6, as below. Quantities were 23 net tons of 12-inch, 7 net tons of 10-inch, 15 net tons of 8-inch, 9 net tons of 6-inch, 24 net tons of 4-inch, and 12,000 pounds of special castings.

Donaldson Iron Company, Emaus, Pa., $31 per ton for 12, 10, 8 and 6-inch, and $37 per ton for 4-inch pipe; special castings, 2½ cents per pound; total, $2,790.

Mellert Foundry and Machine Company, Reading, Pa., $32.50 per ton for 12 and 10-inch, $32.75 for 8-inch, $33 for 6 and 4-inch, and 2¾ cents for special castings; total, $2,933.25.

Jackson & Woodin Manufacturing Company, Berwick, Pa., $33.25 per ton for 10, 12, and 8-inch; $33.75 for 6-inch, and $31.50 for 4-inch; special castings, 3 cents; total, $3,012.

Buffalo Cast-Iron Pipe Company, Buffalo, N. Y., $35 per ton for all pipe, and 3 cents for castings; total, $3,090.

John J. Fisher, Allentown, Pa., $32.48 for 6-inch, $32.95 for 4-inch, 2½ cents for castings.

Sayre Pipe Foundry Co., Sayre, Pa., $31.80 for 10 and 8-inch, $34 for 6 and 4-inch, 3 cents for castings.

McNeal Pipe and Foundry Company, Burlington, N. J., $34.25 for 12-inch, $34.75 for 10 and 8-inch, $35.60 for 6-inch, $37 for 4-inch, 3⅛ cents for castings; total, $3,135.65.

Florence Iron-Works, Philadelphia, Pa., $34 for 12 and 10-inch, $35 for 8 and 6-inch, $36 for 4-inch, 3 cents for castings; total, $3,084.

The contract was awarded to the Donaldson Company.

ROCHESTER, MINN.—Excavations have been made for new jail and sheriff's residence, to cost $20,000.

ST. PAUL.—The School Board has awarded contracts for ventilating and heating the following schools to Holland & Thompson of this city: Madison school, $7,665; Jefferson school, $7,076; Lincoln school, $5,254. Contracts have been awarded for additions to schools as follows: Jefferson, four rooms, to W. J. Gronewald, $20,500; Cleveland, four rooms, to Welcken & Wildung, $19,900; Gorman, four rooms, to Trick & Co., $16,160.

Plans for new buildings in the Mississippi Street, St. Anthony Park North, Macalister, Como and Hamline districts have been received and adopted by the board.

INDIANA, PA.—The following contracts have been awarded for the new jail and remodeling the Court House: Steam-heating and all the steel cell work to Sutton Brothers & Bell, of Indiana, for $14,700; plumbing to McMillan & Waters, of Johnstown, Pa, $1,885; stone trimming to the Cleveland Stone Company, $2,404.

SCHENECTADY, N. Y.—Bids for cast iron water-pipe were opened by the Water Commissioners, May 9, as follows: Florence Iron Works, Florence, N. J., 600 feet of 8-inch pipe, $35 per ton of 2,000 pounds; 1,500 feet of 6 inch, $35.50; 3,000 feet of 4-inch, $36; specials, three cents per pound.

M. J. Drummond, 120 Broadway, New York City, $35.75, $35.75, $37.00, 3 cents, respectively.

John J. Fisher, Allentown, Pa., no bid, $36.40, $36.90, 2½ cents, respectively.

Jackson & Woodin, Berwick, Columbia Co., Pa., $37.25, $38.25, $40.25, no bid for specials.

The bids of all except the Florence Iron-Works are per ton of 2,240 pounds.

CEDAR RAPIDS, IOWA.—The following bids for a system of sewers in District No. 1 were received by the Sewerage Committee, Chester B. Davis, of Chicago, Consulting Engineer, April 28: William A. Doyle, Kalamazoo, Mich., and M. Jackson, Cedar Rapids, Iowa, (jointly), bid a total of $83,081 for the 18 sections; J. H Harlow & Co., Pittsburg, Pa., bid a total of $65,290 for 13 sections. (This firm did not bid on sections 1, 2, 12, 13, 18.) John Duffy, Chicago, bid $115,413.59 for 18 sections. Bids for extras were as follows: Doyle & Jackson, for extra lampholes, $4 to $11,50, manholes, $30 to $45, flushing-tanks, $30 to $40; J. H. Harlow & Co., manholes, $41 to $50, flushing-tanks, $47 (no bid for lampholes); John Duffy, lampholes, $2, manholes, $36, flushing-tanks, $35.

The prices for extras vary with the depths.

GOVERNMENT WORK.

BANDS, N. J.—Synopsis of bids for the construction of a life-service station opened May 10, 1887, by superintendent Life-Saving Station: Sherman & Hand, Beach Haven, N. J., $5,300; S. H. Morrison, Camden, N. J., $4,865; A. M. Cox, Barnegat, N. J., $4,741; Francis H. Smith, New York, N. Y., $5,300.

Jerry's Point, N. H., Life-Saving Station: A. T. Wing & Son, Oldtown, Me., $5,800; Jordan & Bond, Auburn, Me., $5,850; Francis H. Smith, New York, N. Y., $5,490; A. T. Blossom, New Bedford, Me., $7,200.

SYNOPSIS of bids for iron-work of approaches to Post-Office and Court-House, at Shreveport, La., opened May 6, 1887, by Supervising Architect, Treasury Department: Champion Iron Fence Company, Kenton, O., $680.17; Van Dorn Iron-Works, Cleveland, O., $852.25; Fred J. Myer Manufacturing Company, Covington, Ky., $760.

NEW YORK CITY.—Bids for furnishing pipe, castings, etc., were opened May 2, by Dep. Q. M. General Henry C. Hodges, U. S. A. Quantities, 900 feet of 8-inch terra-cotta pipe; 3,800 feet of 6-inch terra-cotta pipe; 30 Y-branches, 6x4-inch; 720 feet of 8-inch cast-iron pipe; 3,600 feet of 6-inch cast-iron pipe; 2,500 feet of 4-inch cast-iron pipe; two 6-inch quarter-bends; one 8-inch eighth-bend; three 6x4-inch reducers; ten 6-inch sleeves; six 4-inch sleeves; fifteen fire-hydrants; four 6-inch water-gates; two 4-inch water-gates.

The McNeal Pipe and Foundry Company, 8-inch cast-iron pipe, $37.50 per gross ton; 6-inch pipe $38 per ton; 4-inch pipe $40 per ton; quarter-bends, 3½ cents per pound, for delivery on wharf only.

Francis H. Smith, 8-inch terra-cotta pipe-40 cents per foot; 6-inch terra-cotta, 25 cents; Y-branches, $1 each; 8-inch iron-pipe, $44.80 per gross ton; 6-inch iron pipe, $44.80 per ton; 4-inch iron pipe, $44.80 per ton; quarter-bends, 3½ cents per pound; hydrants, $39 each; 6-inch gates, $19; 4-inch $14 each; delivery in August, or earlier, on dock.

Colwell Lead Company, hydrants $24.25 each (Eclipse).

Johnson Foundry and Machine Company, hydrants, $32.50* each; 6-inch gates $16* each; 4-inch gates $11.50* each.

Stewart & Co., 8-inch terra-cotta pipe, 21.37½ cents per foot*; 6-inch terra-cotta pipe, 14¼ cents*; Y-branches, 64.12½ cents*; half collar for each pipe.

M. J. Drummond, 8-inch iron pipe, $36 per ton; 6-inch iron pipe, $37; 4-inch iron pipe, $38; 6-inch quarter-bends, 3 cents per pound; pipes cast, hub-end up.

Builders' Iron Foundry, bends and reducers, $119 for the lot.

Bids marked * have been accepted. No bids were received on iron casting 8x6x6x4 inches, nor on tees and sleeves.

RAPPAHANNOCK RIVER, VA.—Abstract of bids opened May 11, for constructing dikes and mattresses, and furnishing stone, by S. T. Abert, United States Agent. Quantities 815 lineal feet of crib dike, 800 lineal feet of pile dike, 1,616 lineal feet of mattresses, 800 cubic yards of quarry stone:

E. J. Bailey, New York City, crib dike, $6.17 per foot; pile dike, $6.10 per foot; sinking mattresses, $2.17 per foot; stone, $5.50 per cubic yard.

Duncan A. Gillies, Baltimore, Md., $7.49, $5.99, $1.49, $1.25 respectively.

A. Kirkpaugh, Fredericksburg, Va, $5.85, $4.70, $1.25, $1.15, respectively.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 25. PUBLISHED EVERY SATURDAY.

NEW YORK, MAY 21, 1887.
LONDON, JUNE 4, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA

SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

REAL RAPID TRANSIT.

THE problem of rapid transit between the business and residence districts of New York yet remains unsolved, and no steps are being taken toward its solution, so far as we can see. We have discussed this problem from time to time, and we see no reason to alter the opinion expressed in our issue of January 28, 1886 (Vol. 13, p. 199), that the proper solution of the rapid-transit problem for cities, and especially for New York, lies in elevated "viaducts constructed on property exclusively dedicated to that purpose, and on which trains of cars will be propelled at high speed, through the open air, by nearly noiseless motors, two tracks being devoted to long-distance and two to short-distance travel." In a letter to the *Evening Post*, Mr. W. Howard White advocates the construction of a road of the general character we then suggested, but the estimates of cost which he ventures on are so extravagantly large as to indicate that the writer has not examined the subject closely. The cost of construction of such a four-track viaduct would not exceed $600,000 per mile, and the right of way would not average more than $2,500,000 per mile at the outside. We are confident that from the Harlem River to the Battery an expenditure of $30,000,000 would build and equip a four-track viaduct, which would the first year of its operation carry 70,000,000 passengers at a cost for maintenance and operation of not over $1,500,000, leaving six per cent. on the capital to be divided to the shareholders. This estimate of travel is not at all excessive for the time that the road would be ready for travel. The Second and Third Avenue Elevated lines carried 72,000,000 passengers in 1886, and the horse-cars on those avenues nearly as many more. The traffic in New York City increases at the rate of about 20,000,000 passengers a year, and any line which could carry people from the Harlem River to the district below Canal Street in 15 minutes would in five years from this time convey nearer 150,000,000 than the 70,000,000 which we have estimated on.

The wretched rattletraps which now disfigure the streets may by enormous annual expenditure be made to continue to carry the number of passengers they now convey, or even more; but something more enduring, more accommodating, and more scientifically constructed must be had, and it must be above ground. Such a structure honestly built would be remunerative and in every way successful.

A CINCINNATI BUILDING COMMITTEE'S PLAN "TO BRING OUT THE BEST TALENT."

IN our issue of May 7 we criticised the Cincinnati Board of City Hall Trustees, who had instituted a competition for plans of a new city hall to cost $600,000, because of the absurdly inadequate terms proposed in their competition, if as reasonably intelligent men they expected to "bring out the best talent." We supposed Cincinnati would select men of average intelligence to serve on such a committee. It was, therefore, not unreasonable to assume that such a burlesque on a competition as they proposed was merely intended to secure some ideas without compensation, or that they had one or more architects in their mind whose plans they were satisfied they would adopt and yet for appearance sake they proposed to invite outsiders to contribute their time and money in a fruitless effort to get this piece of work. An architect of Cincinnati has sent us a copy of the *Post* of that city in which an interview with a Mr. James M. Glenn, one of the trustees, is reported. This trustee attributed our criticism to the fact that an advertisement for the competition was inserted in two daily papers and was not sent to us, and then showed his appreciation of the proper conduct of an architectural competition and his inability to appreciate the points of our criticism and the position of the profession on this question by stating:

"It is said that we have decided upon our architect, and that for appearance sake we have instituted competition. If we have decided upon an architect I should like to know who he is. The only advantage that any architect has is that of our home people, who are here on the ground, see what we need, and perhaps, for that reason, can make better plans. We offer $300 for the five best designs, and not to exceed $1,500 for the plan which is accepted. These sums are offered to stimulate competition, and, though architects might compete without this inducement, we think this plan is calculated to bring out the best talent. The reason the time of making the plans was limited to June 1 was because we wanted to get the building under headway this summer. Hannaford and other architects were willing to hand in their plans by that time, but Architect McLaughlin, on behalf of the Cincinnati Chapter of Architects, asked that the time be extended, and it has been extended to July 15, though at that late day we will not be able to more than have the foundation laid before the bad weather sets in. Our proposition to return plans to their authors is proper, as many like to retain them. Under these propositions we are receiving applications from competing architects every day, and if there is any partiality or unjustice in it, I am unable to see it."

Our criticism was prompted by the receipt of a circular addressed to the editor, accompanied by a diagram of the ground-space, which circular we supposed was sent us by the Building Committee for notice in our news columns. In view of what has been done within recent years to improve the character of the conduct of architectural competitions, we felt called upon to criticise this action of a committee in an important city, in instituting a public competition, that in its terms ignored all provisions for fair treatment of competitors, and offered such inadequate compensation for the character of work asked for.

We were not able to credit the report that Mr. McLaughlin had, in the name of the Cincinnati Chapter of the American Institute of Architects, asked for an extension of time, thus practically countenancing this burlesque of a competition. We, therefore, telegraphed to a correspondent to ascertain if this statement was true, and received in reply a despatch saying: "City hall competition arranged without consulting architects. Institute committee requested changes, but trustees extended time only." This puts a somewhat different face on the matter than would appear from the statement of Mr. Glenn; yet it would seem that the Cincinnati Chapter of Architects should promptly discountenance this so-called competition.

We do not believe the statement that architects of standing are willing to submit plans on the terms proposed, which give the committee the right to appropriate their designs on the payment of a sum not exceeding one-quarter of

one per cent., when the American Institute schedule of charges is one per cent. for preliminary drawings.

There should be no criticism if the committee, without competition, were to employ any capable and experienced architect who is familiar with the problem, but the reprehensible part of the whole business is that they ask outsiders to waste their time and money to send them designs, when on the face of the thing it is obvious they expect one or two local men will secure the work; though they evidently would like to have the chance to appropriate any desirable feature of the designs of others without adequate compensation. For the information of this committee and such members of the profession who have forgotten it, we devote space elsewhere to reprint the proposition adopted by the Western Association of Architects at their meeting in St. Louis, in November, 1885, also the terms of the Kansas City competition, the adoption of which was such an important step in advance in this vexed problem—architectural competitions—and which, so far as we have been informed, secured such satisfactory results, considering a competition was resorted to.

Now, that these trustees may understand our criticism, we would say that they should either adopt terms somewhat on the lines of the Kansas City competition, or have a paid close competition, as in the case of their Chamber of Commerce Building, or they should withdraw their proposition and select the architect they want and give him the work out and out. And if they make a judicious selection from among their local architects, we have no doubt they will get a satisfactory building, and they will not be responsible for an attempt to take advantage of a lot of inexperienced men who, in their anxiety to get work, may be tempted to throw away their time and labor in the hope that "lightning may strike them." In this emergency the Cincinnati Chapter of Architects should promptly protest against this libel on a competition, or the conclusion will be that its influence in favor of good architecture and decent treatment of architects is *nil* in that community.

OUR BRITISH CORRESPONDENCE.

System of Instruction at the Crystal Palace School of Engineering—Objections to Heavy Steam-Rollers, owing to Damage to Gas-Pipe—Congress of Hygiene at Vienna—The Charity Organization Society.

LONDON, May 4, 1887.

IN presenting the certificates to the students of the Crystal Palace School of Engineering, a few days since, Sir Robert Rawlinson stated that any applicant for admission as a student at the Institute of Civil Engineers, having passed through the school, was always admitted, testifying thereby to the value of the teaching received. He advised those leaving the school not to pick and choose work offered them under the impression that any honest work was degrading, but to take the first that presented itself and persevere. He pointed out the fields opening up for young and capable engineers in Japan, China, India, Australasia, North America, and South Africa. The complete course at this Engineering School covers three years, and embraces in the first year's course, mechanical engineering, practical instruction and work in the drawing office, pattern-shop and fitting-shop; the second year is devoted to civil engineering, and the third (for such as require it) is given to instruction in special work, with a view to colonial work. The system adopted is to give both theoretical and practical work, and some idea of the quality of work turned out may be gathered from the fact that a leading engineering firm in the Midlands purchases the engines constructed every year in the school, which, with the exception of the large casting, are built throughout with parts cast, turned, and finished by the students. The Principal is Mr. J. W. Wilson, M. I. C. E., M. I. M. E., and the Vice-Principal his son, Mr. J. W. Wilson, Jr. M. I. C. E., M. I. M. E.

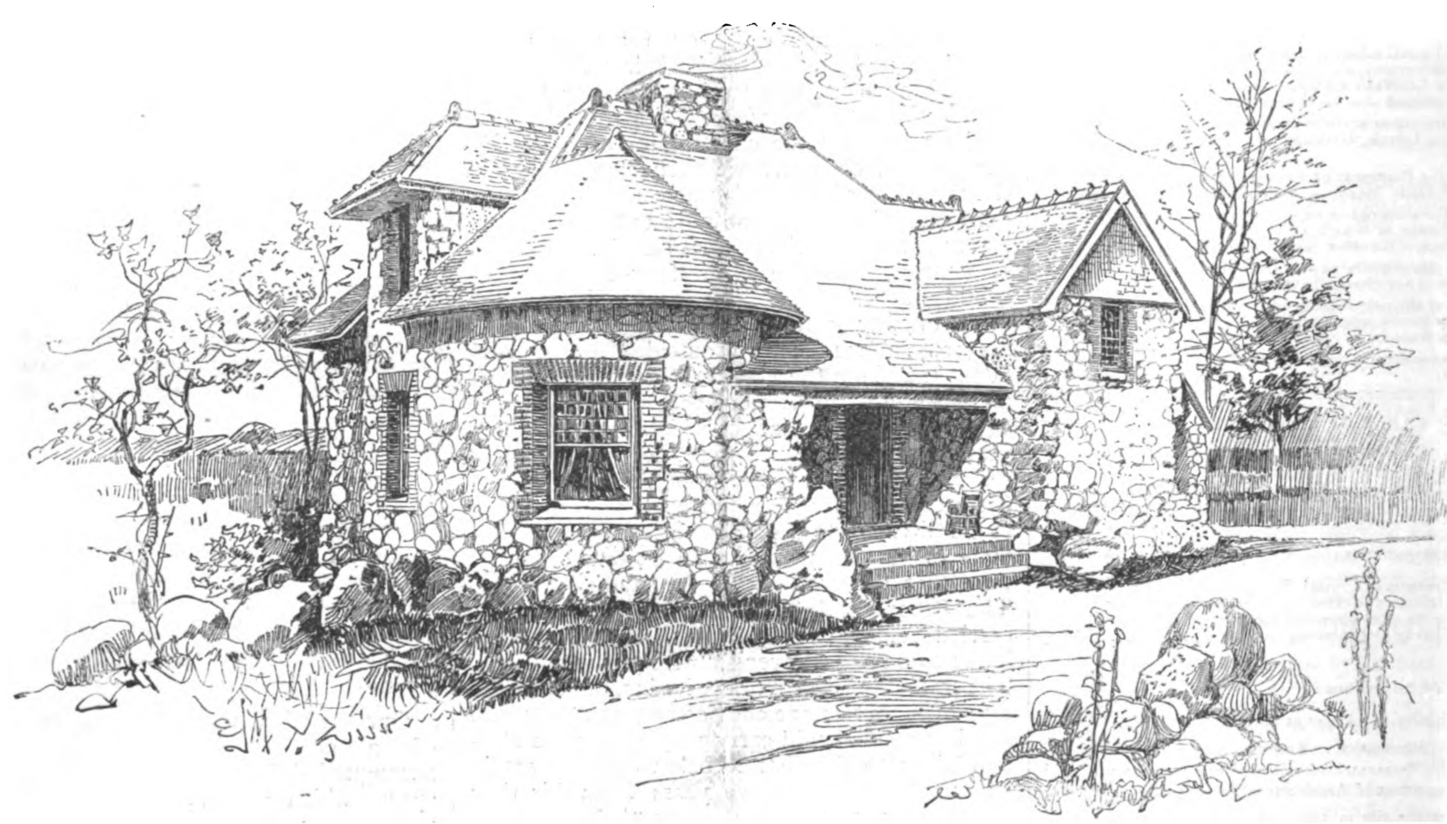
The Gas-Light and Coke Company, in a legal action, in which the Vestry of St. George's, Hanover Square, were defendants, have successfully maintained that 15-ton steam-rollers should not be used in road-making. The contention of the gas company was based on damage done to mains and pipes by the weight of the rollers. The case emphasizes a point in favor of subways for carrying the mains in all new streets, similar to those along the Embankment and several new leading thoroughfares.

The sixth International Congress for Hygiene and Demography is announced to be held in Vienna from 26th September to 2d October next. The subjects proposed for discussion are: Sanitary properties of water for general purposes; the purification and use of waste waters, etc; the Waring and Shone canalization systems; food adulteration legislation; milk for infants; alcohol; quack medicine legislation; acclimatization; sunlight and heat; electricity and gas; school hygiene; factory legislation; isolation and construction of hospitals; disinfection; rags as a means of spreading infectious disease; recent cholera epidemics and their lessons; predisposition of various races towards infection; ship hygiene; international regulations for epidemics; vaccination (for the human race and animal kingdom).

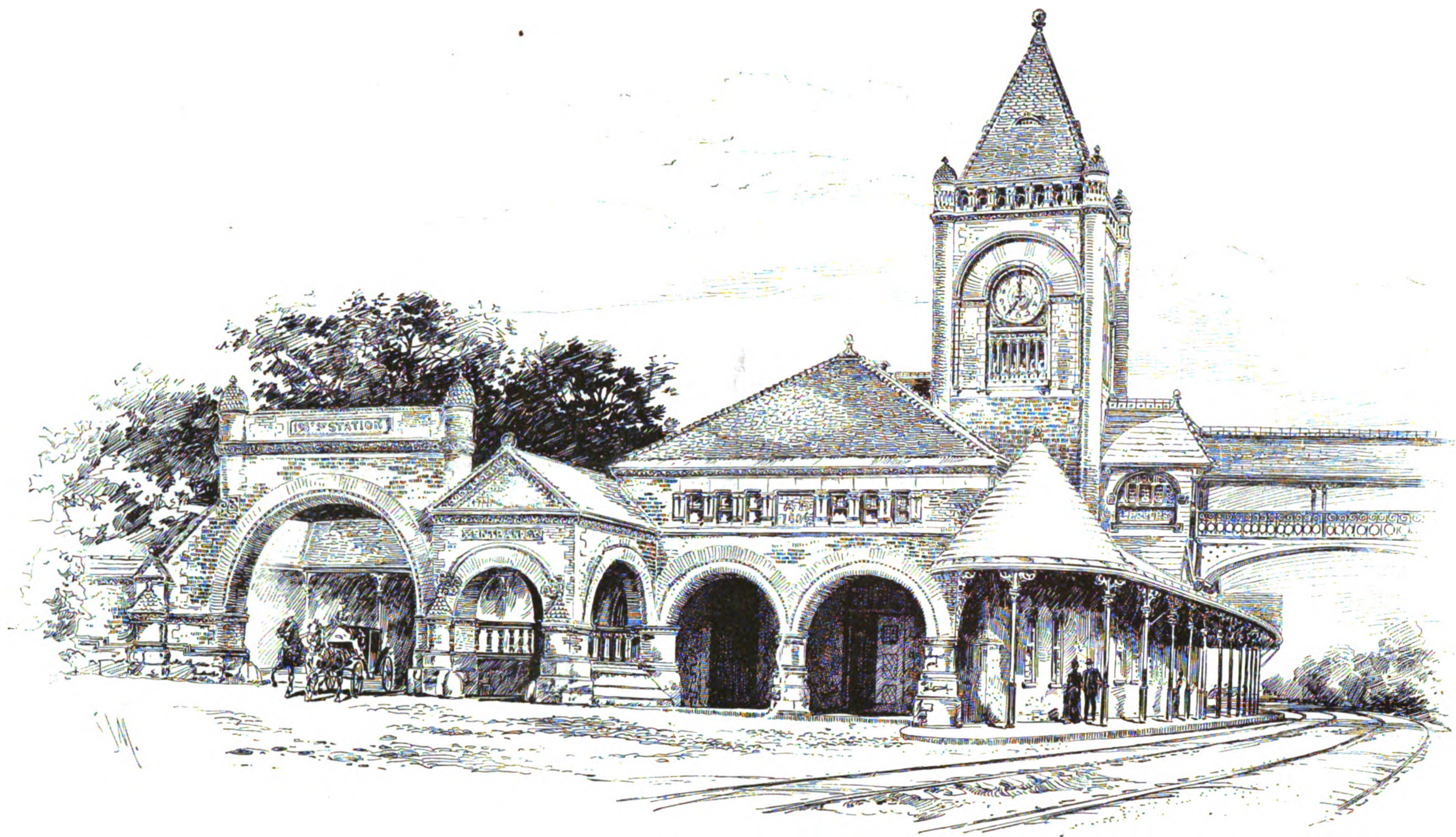
The physicians and surgeons of the leading London hospitals have issued a circular-letter to the press calling attention to the convalescent work done by the Charity Organization Society, and asking the public to assist with funds. Last year 2,207 poor patients were sent to convalescent homes by the society, monetary assistance being granted to the families during the bread-winners' absence. The work is unquestionably valuable, and should meet with a large measure of sympathy and support.

SAFETY-VALVE.

PROFESSOR G. POUCHET, of the Faculty of Medicine of Paris, states that in the course of an experiment he accidently inhaled the vapors of the poisonous alkaloid produced by Koch's bacillus. The result was an intense chill, followed by very unpleasant chilliness for thirty-six hours with nausea, dilatation of the pupils, and abdominal discomfort. A student who was working with him, and who also inhaled the vapors, was affected in the same way.—*Rev. de Med.*



PORTER'S LODGE AT NORTH ANDOVER, MASS.—HARTWELL & RICHARDSON, ARCHITECTS.



THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

MOTT HAVEN DEPOT, NEW YORK CENTRAL AND HUDSON RIVER RAILROAD.

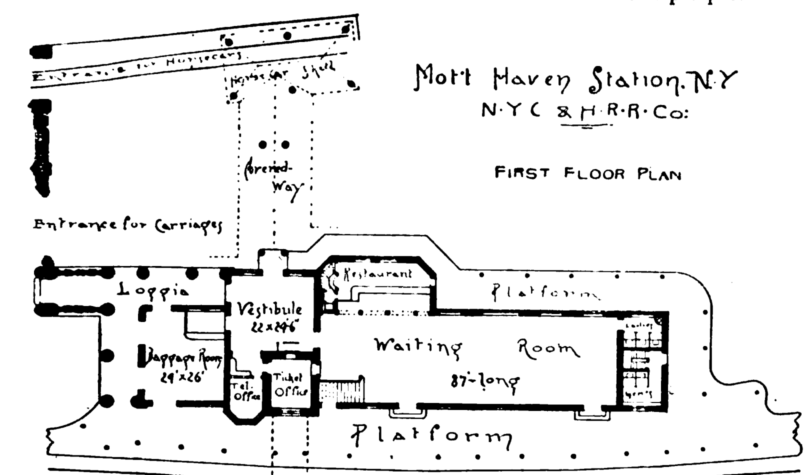
R. H. ROBERTSON AND A. J. MANNING, ARCHITECTS

ENGINEERING & ARCHITECTVRE

OUR SPECIAL ILLUSTRATION.

DEPOT AT MOTT HAVEN, NEW YORK.—MESSRS. R. H. ROBERTSON AND A. J. MANNING, ASSOCIATED, ARCHITECTS.

THE subject of our special illustration this week is the depot of the New York Central and Hudson River Railroad at Mott Haven, New York City (One Hundred and Thirty-eighth Street). The building is constructed of



brick, stone, and terra-cotta, with a roof of Akron tile. The depot stands on the west side of the tracks, and there is a bridge from the second story of the tower across the tracks to the east side. The cost was $70,000. Messrs. R. H. Robertson and A. J. Manning, associated, of New York, were the architects.

OUR VIGNETTE ILLUSTRATION.

EXCHANGE LODGE, NORTH ANDOVER, MASS.—MESSRS. HARTWELL & RICHARDSON, ARCHITECTS, BOSTON.

REGARDING THE CONDUCT OF ARCHITECTURAL COMPETITIONS.

THIS is the reprinted matter referred to in our editorial elsewhere:

THE COMPETITION FOR THE BUILDING OF THE EXCHANGE BUILDING ASSOCIATION, KANSAS CITY.

We commend to those who institute architectural competitions the example of the committee of Kansas City Exchange Building Association in appointing a professional adviser to draw up the conditions of the competition, and advise them in making their decision. The instructions sent out by the committee, which were drawn up by their adviser, Mr. W. R. Ware, professor of architecture in the Columbia College School of Mines, will form a very valuable precedent in all future important architectural competitions, and we feel very confident that the result of a competition conducted as this is to be will be such as should encourage others to follow the example of the Kansas City committee.

The announcement of the competition begins by stating that the Exchange Building Association proposes to erect a building "at an expense not to exceed $400,000, and have appointed a building committee with full power to select an architect to carry on the work," and that a certain number of architects have been invited "to prepare a sketch or preliminary design for the proposed structure, for which they will be paid the sum of $500 each. Notice has also been given through the public prints that the committee will receive and entertain designs by other architects not so invited. Designs must be made in conformity with the following instructions.

After a careful description of the site, giving the character of the foundation to be found, etc., and a full and precise statement of the accommodation required in the building, the instructions continue:

The following drawings, and these only, will be furnished by each competitor. They will be accompanied by a brief memorandum, copied with a type-writing machine, explaining any points in the design not obvions from an inspection of the drawings:

Plans of the different stories, and of the basement.
Three elevations.
Two sections.
A perspective.

These will all be drawn to a uniform scale of one-sixteenth of an inch to the foot, and finished in line with India ink with the drawing-pen. They are to be back-lined, and no shadows are to be cast. There is to be no brush-work except in blacking in the windows and the sections of the walls and floors. The lettering and figuring is to be plain and simple, like ordinary printing-type, and is to be confined to the names and dimensions of the rooms, written in the middle of each, without explanatory comments, which are to be put by themselves, as has been said, in a separate memorandum.

If the plans of two stories are identical, one may be omitted; and if two of the stories are exactly symmetrical in plan, half only of either need be shown.

The perspective also is to be drawn in line only, without figures, background, or foreground, and without shading, even in the windows; the building to be set at an angle of 45 degrees with the plane of the picture—the vanishing points being set thirty inches apart, and the nearest point of the building, which is to be the south-east corner, set twelve inches from the right-hand vanishing point. The horizon is to be taken at the level of the principal floor. The scale of the perspective is to be one-third as large again as that of the elevations, on the nearest corner, or one-twelfth of an inch to the foot.

These drawings are to be made each upon a half-sheet of imperial paper (or upon a sheet of tracing paper, not tracing cloth, mounted upon imperial paper), the paper, being cut down to the dimension of 13 inches by 20 inches, and surrounded with a single line for a border. Each drawing, and also the accompanying memorandum, is to be distinguished by a motto or cipher, and no handwriting, of any sort is to be put upon either. A sealed envelope, bearing the same cipher or motto, is to contain the name and address of the writer, and he may enclose with it any information in regard to his training, experience, or present professional position, and his qualifications for carrying out the designs necessary to the completion of the work, or for conducting the work itself, to a conclusion, or for both, which he may desire to bring to the notice of the committee. *The architects specially invited by the committee will please distinguish their designs by putting a circle an inch or two in diameter upon the back of the drawings. Before making a final choice the committee and their professional adviser will open the envelopes containing the names of the authors of the most approved designs, in order that, other things having been first considered, purely business considerations may have their proper weight.

These drawings are not to be framed, glazed, or even mounted on cardboard, but are to be sent flat, in a portfolio, expressage paid, on or before June 15, 1886, to Professor William R. Ware, Columbia College, New York, N. Y., whom the Exchange Building Association have appointed to act with the committee as their professional adviser. He will employ a competent person to throw out from consideration all drawings or sets of drawings not made in conformity with these printed instructions. The remainder he will examine and will select those he finds to be the best among them, at least three in number, which he will hand over to the committee with his comments and recommendation.

The committee, in consultation with their professional adviser, will assume the entire labor, responsibility, and expense of making estimates for the work on the basis of the designs selected by them, employing a competent surveyor to that end.

The committee will forthwith appoint one of the selected competitors as architect of the building, if they find that, in their judgment and that of their adviser, they are warranted in doing so. But if, as may happen, they find themselves unable to choose, upon the evidence before them, between two or more of these candidates, they will invite the competitors among whom their choice then lies, to present, under the instructions of the committee, such further explanations as the nature of the questions at issue may require, and, if they find it necessary to do so, will institute a second competition among them, for which a sufficient time will be allowed. The committee will then, after consultation with their professional adviser, select one of the competitors so invited to be the architect of the building, and will execute an agreement with him for the customary professional compensation, for such services, as declared by the Western Architects' Association, and by the American Institute of Architects.

The committee reserve the right, in case their choice falls upon an architect who was not in the first instance invited to enter this competition, and whose experience and professional position do not, in their judgment, warrant them in putting the practical conduct of the work into his hands or upon one who, by reason of distance, does not wish to undertake it, to associate with him some experienced person, to be nominated by him, upon whose competency in this respect they can rely, paying to each the customary fees for his share of the work.

Each of the architects invited to take part in this second competition, should such a competition be instituted, will receive from the committee a sum not exceeding $400 as compensation in full for these additional services, whether he is or is not among the number of those who have been specially invited by the committee to take part in the original competition. But unsuccessful competitors not so invited will not receive any remuneration.

In the case of the successful competitor, these payments will be considered as payments on account of his commissions as architect of the building.

All drawings will be returned to the competitors, as soon as the committee has made its selection; and they will not be shown to the other competitors, nor to the public, without the consent of their several authors previously obtained in writing. Nor shall anything shown in any of the rejected designs, or otherwise suggested by the unsuccessful competitors, which is original as to this competition, be adopted and made use of in the building, without the consent of its author, and proper remuneration being made him; the amount thereof to be agreed upon between him and the committee, and in case of disagreement to be referred to their professional adviser.

Any information which the committee, or any member of the committee, or their professional adviser, may find proper to communicate to any one of the competitors, in answer to questions or suggestions, will be made in print, and will be simultaneously communicated to all the rest. Such questions or suggestions must be made before the fifteenth of May, and should be addressed to one of the undersigned, who will communicate with each other before replying.

The final action of the committee, and the report to them of their professional adviser, will be communicated to all the competitors.

EDWARD H. ALLEN,
President of the Exchange Building Association, Kansas City, Missouri.

WILLIAM R. WARE,
School of Mines, Columbia College, New York, N. Y.

One or two minor points are perhaps open to criticism. The advisability of limiting and circumscribing to the extent here done the character of the rendering of the perspective is, we think, open to question, and the condition that the drawings are to be "back-lined" seems to us needlessly harassing. It seems a great pity that this provision should be introduced, when in all the rest of the instructions such pains have been taken to exclude unnecessary labor. Back-lining adds a great deal of trouble to the making of the drawings, and is to our mind in all cases a most undesirable practice. We do not think it ever adds to the appearance of a set of drawings.

In the main, however, these instructions are to be highly commended, and we trust will have much influence in the conduct of future competitions throughout the county.

CODE.

To be addressed by building committees to architects.

Mr................ ... ., Architect.

DEAR SIR: The..................Board has determined to erect a building for the following uses:

The Board has appointed the undersigned a Building Committee, with full power to select and contract with an architect.

The building is to be located......................

And must fulfill the following requirements—viz.:

The cost of the completed structure (not including architect's fees must not exceed.....................

The Board is assured by the following well-known building experts ....that the building can be completed for the above sum.

The Committee hereby invites you to form one of ....architects to compete for the position of architect, under the following agreement:

The Committee has selected Mr..... ... .as its juryman, and you are invited to meet the competitors on... ..day............ to select your juryman at... ....

Each design to consist of the following drawings .... all executed in a uniform method of presentation, and to a uniform scale, as follows:

All drawings and descriptions must be in at noon on the.......day of ....188..each set inclosed in a portfolio to be placed in the hands of Mr...................of.... ....No........ Street, who has been appointed the custodian, and who shall immediately there and then open the portfolios in presence of the competitors, no one else to be present; and he shall cull out every drawing or description in which is noted anything not in strict accordance with the above restrictions. No competitor to be allowed to put in any alternative or extra drawings, details, or sketches.

The Committee agrees that the selection of the best design, which also shall carry with it the appointment of the designer as architect of the building, shall rest in an expert jury, consisting of three members, one of whom shall be selected by the competing architects, one by the Building Committee, and the third by the other two. The jurymen shall all be expert architects, and not of the town where the building is to be erected. The Building Committee agrees to meet all expenses of this jury.

The jury, publicly or privately, is not to look at any of the drawings for this building other than those that shall be delivered by the custodian, and which have been found to meet the exact requirements hereinbefore set forth, and to base its decision strictly on the merits of the designs so submitted.

* This requirement was subsequently withdrawn.--[Ed.]

The Committee agrees that the jury shall be left perfectly free, and that no preference or leaning of the Committee, or any member of it, hall be conveyed to any juryman publicly or privately, directly or indirectly, till the decision of the jury has been reached and published.

The Committee further agrees, when the competition has been decided, to return each set of drawings except the one presented by the successful architect; and, further, that no part of any rejected design, that is original as to this competition, shall ever be used in the construction of the building, without the written consent of the designer thereof.

A written or printed description of the building may accompany each set of drawings, the same being presented in plain black and white, without any sketches interspersed; and these descriptions shall pass through the custodian's hands as above provided for drawings, and shall be subject to rejection if the requirements are exceeded; and no other writings or descriptions shall be considered by the jury in forming a judgment.

Before any design is finally premiated, the cost of a building shown by it shall be determined by an assessor, who shall be under oath, and who must be satisfactory to a majority of the competitors and the committee.

Should the assessor claim that a building cannot be erected according to any given design for the sum mentioned, the designer thereof shall be heard by the jury before throwing him out of competition on this account. Should the jury then determine that the assessor is right, they must throw out the design which is so shown to be too costly, and proceed to premiate the design by another--one of the architects in the competition. Cost of assessor and his expenses to be paid by the building committee.

The jury shall not allow any personal conferences with any competitor, either in public or in private, other than those proper consultations to be held between the jury as a whole and the individual competitor, for the purpose of receiving necessary explanations in regard to the design.

The jury shall positively premiate one of the designs hereby called for in this competition and this judgment shall be final and conclusive, the committee reserving the right to afterward alter or change the one chosen, if desired, but this last clause is not to be construed as revokwhat has been said above as to the cost of building from the design when submitted to the jury.

The committee agrees that the premiating of a design by the jury shall carry with it the appointment of its maker as architect of the building, with the regular compensation as allowed by the schedule of charges adopted by the "Western Association of Architects."

The decision of the jury shall be published on or before the........ day of ... .

Should any competitor seek any further information than that above stated, the Committee must send the answers to him and all other alike, in order to keep each competitor on exactly the same basis as the rest throughout the competition.

All who may come into the competition shall be subject to the same rules as above.

No competitor shall serve on the jury in any capacity whatever, or be allowed to give any advice in any matter relating to this competition.

Should the work not proceed within one year from date of the selection of the design, the premiated architect shall then be paid for what he has already done up to that date, according to the schedule of charges adopted by the Western Association of Architects, his design in competition, being ranked as full primary sketches. Whenever the work shall proceed thereafter the premiated architect shal still be the architect, having full charge as above mentioned.

Schedule of charges and professional practice of architects, as usual and proper, and endorsed by the American Institute of Architects.

For full professional services (including supervision) 5 per cent upon the cost of the work. In case of the abandonment of the work, the charge for partial service is as follows: preliminary studies, 1 per cent.; preliminary studies, general drawings and specifications, 2½ per cent.; preliminary studies, general drawings, specifications, and details, 3½ per cent.

For works that cost less than $10,000 or for monumental and decorative work, and designs for furniture—a special rate in excess of the above.

For alterations and additions—an additional charge to be made for surveys and measurements.

An additional charge to be made for alterations or additions in contracts or plans, which will be valued in proportion to the additional time and services employed.

Necessary traveling expenses to be paid by the client.

Time spent by the architect in visiting for professional consultation, and in the accompanying travel, whether by day or night, will be charged for, whether or not any commission, either for office work or supervising work, is given.

The architect's payments are successively due as his work is completed, in the order of the above classifications.

Until an actual estimate is received, the charges are based upon the proposed cost of the works, and the payments are received as installments of the entire fee, which is based upon the actual cost.

The architect bases his professional charge upon the entire cost, to the owner, of the building when completed, including all the fixtures necessary to render it fit for occupation, and is entitled to additional compensation for furniture or other articles designed or purchased by the architect.

If any material or work used in the construction of the building be already upon the ground, or come into possession of the owner without expense to him, the value of said material or work is to be added to the sum actually expended upon the building before the architect's commission is computed.

SUPERVISION OF WORKS.

The supervision or superintendence of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk of the works) means such inspection by the architect, or his deputy, of a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in conformity with his designs and specifications, or directions, and to enable him to decide when the successive installments or payments provided for in the contract or agreement are due or payable. He is to determine in constructive emergencies, to order necessary changes, and to define the true intent and meaning of the drawings and specifications, and he has authority to stop the progress of the work and order its removal when not in accordance with them.

CLERK OF THE WORKS.

On buildings where it is deemed necessary to employ a clerk of the works, the remuneration of said clerk is to be paid by the owner or owners, in addition to any commissions or fees due the architect. The selection or dismissal of the clerk of the works is to be subject to the approval of the architect.

EXTRA SERVICES.

Consultation fees for professional advice are to be paid in proportion to the importance of the questions involved, at the discretion of the architect.

None of the charges above enumerated cover professional or legal services connected with negotiations for site, disputed party walls, right of light, measurement of work, or services incidental to arrangements consequent upon the failure of contractors during the performance of the work. When such services become necessary they shall be charged for according to the time and trouble involved.

DRAWINGS AND SPECIFICATIONS.

Drawings and specifications, as instruments of service, are the property of the architect.

REGARDING MATHEMATICS IN THE STUDY OF ARCHITECTURE.

MR. E. M. WHEELRIGHT, of Boston, writes:

"In reply to Mr. Osborne's query in your issue of May 7, I consider that a *thorough* training in geometry, conic sections, algebra, and trigonometry is very important for an architect. Yet I know some very good architects who have had much less mathematical training than this, and others who have found a more advanced training in mathematics of great service in the sort of work for which they have had a natural bent. The advantage of such training, as in all training, is in proportion to the nature of the student. I think, however, that any regular architectural course should include as much mathematics as stated above, and that a greater requirement in those branches is unnecessary for the average student."

Messrs. Andrews & Jaques, of Boston, write:

"Regarding the questions raised by Professor Osborne, we would say decidedly that a 'thorough training in geometry and conic sections, algebra and trigonometry,' *would* 'give the architectural student all the purely mathematical knowledge that is necessary.' These things we hold to be necessary to a broad, sound architectural education and the lack of them must hamper an architect gravely, however quick he may be at meeting new problems as they come along. In our opinion it is only after some practice that the individual can really tell whether it would be at all worth his while to acquire more of mathematics than he had gained from the above-mentioned courses. We doubt if one man in a hundred would ever feel such a need, so that we would not recommend taking up the time of the other ninety-nine with demonstrations which they would soon forget, having no practical use for them."

MR. C. H. BLACKALL, of Boston, writes:

"SIR: It seems to me that Mr. Osborne is quite right in the question he poses in your late issue. Architecture and art in general are so intangible in their nature that the student beginning with the profession is very apt to feel a desire for positive knowledge, and after he has spent a year or two in pure art studies with but slight apparent improvement, he naturally is not as well satisfied with his progress as though he had studied and mastered a set number of abstruse mathematical theories. A college curriculum generally will put too much stress upon the studies which are avowedly simply means of training the student's mind. These do very well for one who contemplates a scholastic life, but the architect will have abundant opportunity for mental gymnastics when he comes to grapple with the construction and planning of a large building, to say nothing of the hard, persistent study necessary to evolve a complete, coherent architectural design. It seems to me that the fact cannot be too firmly impressed upon the beginner's mind that construction, mathematics, and practical details generally, are mere adjuncts to architecture, and however necessary or important they may become they should always be subordinated to the divine fire which marks the difference between architecture and engineering.

"But to deal more directly with the point of Mr. Osborne's query, my own experience leads me to agree unreservedly with his statement about the amount of mathematics required. The theorems made use of in architectural computations are few in number and quite simple in their nature. After the student has crossed the *pons asinorum*, can solve an equation, understands the relations of the parts of triangles and is familiar with the trigonometric functions, he needs only a liberal allowance of common sense and a volume of Trautwine to enable him to make all the calculations involved in any ordinary building operation. If he is ambitious enough to master the elementary problems of descriptive geometry and will study thoroughly graphical statics, he is ready for anything he could ever possibly encounter in professional work. To study higher algebra, calculus, analytical geometry, or any of the higher mathematics, is more than useless. Life is too short and art is too complex in its nature for the student to spend his time over that which will profit him not."

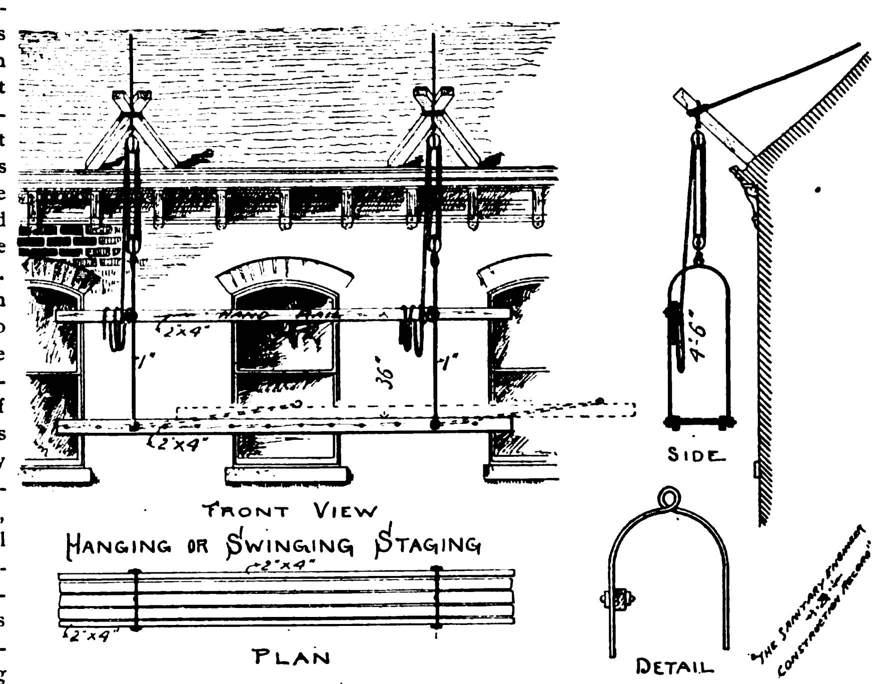
THE New York Chapter of the American Institute of Architects held its monthly meeting at No. 18 Broadway, Wednesday afternoon, May 11. The attendance was large and the chief question for discussion was the new Tenement-House law.

PAINTERS' AND BUILDERS' HANGING STAGINGS IN PARIS.

THE following described staging is used by house and sign painters, blacksmiths, masons and others having work to do on the outside of walls or buildings. One of the city ordinances of Paris enact that all house-fronts shall be washed or scraped every ten years. This used to be done by scraping the limestone masonry, but besides the inconvenience of dust and noise this method, of course, wore off the surface, especially of carvings and consequently gave wider joints on the face, the stone being jointed back only about one inch.

To-day this cleaning is done by water and brushes. Either hot or cold water applied by means of flying stagings with hose. The water is forced up by rotary hand-pumps placed in the yard of the building. One man at a pump usually supplies two hosemen on the staging, each using a stiff brush on the surface of the stone. Another advantage of this method of washing is that the stone does not come out with that glaring, dazzling white color which it has when newly scraped.

This staging is formed of two longitudinal sticks of 2x4 stock joined by a series of long rods or bolts of iron on which board or planks are laid to form the floor. Near each end of this frame-work are fastened two frames of band-iron rods as shown to which the blocks and falls are hooked. On the outer side of these frames is a hand-rail of 4x2-inch stock about 3½ feet up from lower frame, forming a protection and support for the workmen. The iron frames are sufficiently high to allow of passing under them without crawling, but simply by stooping. At the cornice of building the falls and blocks are suspended from a pair of wooden shears held up by rope made fast to chimneys or ridge hook.



This staging is easily raised or lowered by a single man, working first on one, then on the other fall; or, better still, by two men working together. The platform is perfectly safe and has plenty of room for pails, tools, etc. If necessary, rollers can be adapted to projecting arms to bear against building, but this is usually unnecessary, the shears being swung out far enough so that the staging will hang clear of building. When not in use the iron frames fold down on to bottom, so that it takes no more room than a ladder and is easily transported.

RECENT WATER-WORKS CONSTRUCTION.

No. XII.*

WATER-WORKS OF CHARLOTTESVILLE, VA.

CHARLOTTESVILLE is the shire town of Albemarle County, Va. It has within its corporation limits a population of about 3,500. The University of Virginia is located just outside the corporation, and this, with the students and persons connected therewith, together with the people living in the immediate vicinity, comprises about 2,000 more. The town and the university having united in the introduction of water, provision was made for supplying a population of 5,500 and a future growth.

The work was done from plans by Ernest W. Bowditch, of Boston, engineer in chief, E. D. Bolton, of Boston, being engineer in charge of construction.

The plan adopted is that usually known as the "gravity system." A dam was built across a deep and narrow valley in the Ragged Mountains, about 5½ miles from the town, through which a stream fed by springs flows, and a pipe line was laid passing through the university grounds to the town.

The sides of the valley are very steep, underlaid with ledge and covered for the most part with grass and timber. In ordinary seasons the stream will furnish a supply much beyond the present requirements of the town, but provision has been made to store the surplus rainfall as well, the reservoir having sufficient capacity to carry the town through any possible drought.

The dam is 45 feet high above the level of the meadow and 530 feet long; the reservoir has a water area of about 32 acres at high-water level, and a capacity of 189,000,000 gallons. It is built of earth, with a core of rubble masonry rnnning through the centre, well laid in cement, and pointed very thoroughly and carefully on the inner side with Portland cement. This core is 8 feet wide at the base at the lowest point, the width at the base varying with the height, and 4 feet wide on top. The foundation in the middle is about 15 feet below the general surface of the meadow and 10 feet wide. The materials at the bottom of the foundation are solid rock, very compact rotten rock, and clayey gravel. Where the softer portions of the rotten rock and gravel were found a bed of concrete 30 inches thick and 12 feet wide was put in and the masonry started from that. The concrete was also brought up on the inner side of the wall to the original surface. The stone used was a granite quarried near the site of the dam, and was very hard and compact, the finer-grained pieces being reserved for the gate-house.

The cement used was the "James River" brand, manufactured by H. O. Locher, at Balcony Falls, Va. The earth-work is 12 feet wide on top, and about 190 feet at the bottom at the widest part, the slopes being 1½ to 1 on the outside and 2 to 1 on the inside, the inner slope being broken by a berme 7 feet wide about midway from top to bottom, and the upper section paved.

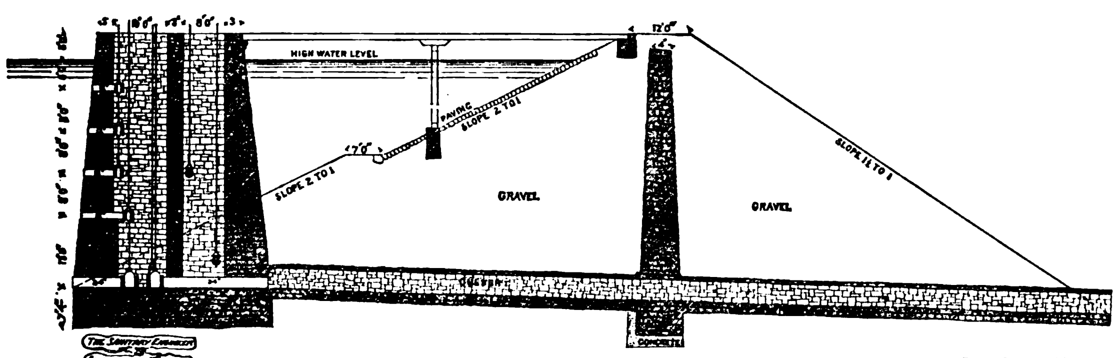
As the masonry was carried up the earth was put in place in layers and thoroughly rolled and compacted. All the teaming was also done over the embankment. The outer slope was dressed down and seeded.

The gate-house, which is set out into the pond, is built of stone with quarry faces and squared joints. It is arranged with two chambers, either of which can be used independ-

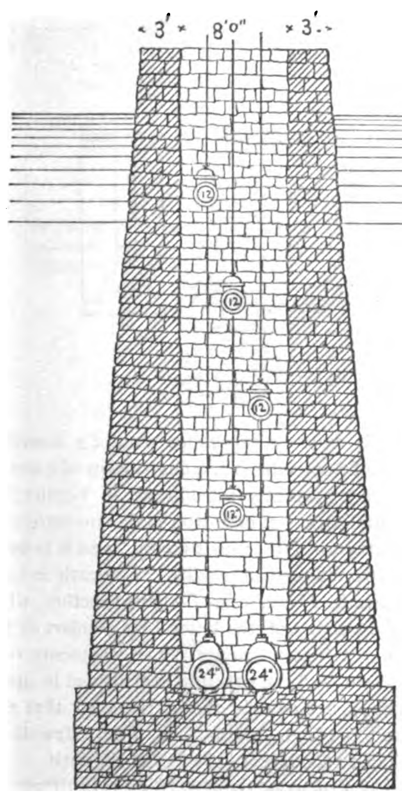
* No. XI., Water-Works of Putnam, Conn., was published on page 86, issue of April 9.

CHARLOTTESVILLE WATER WORKS.

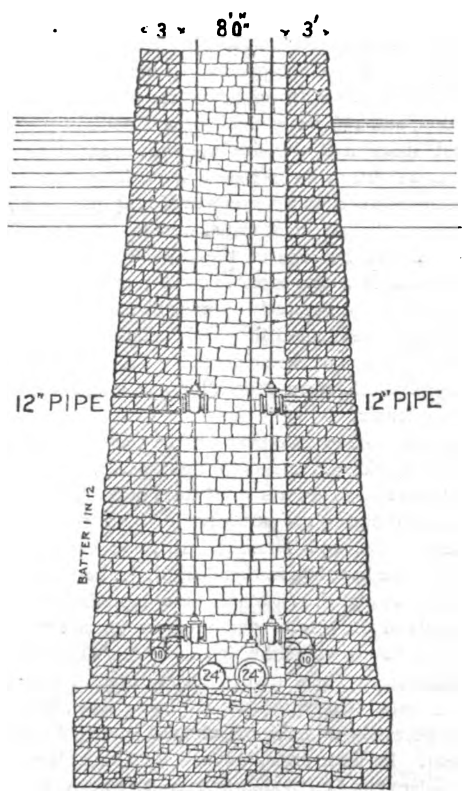
1885.



CROSS SECTION THROUGH GATE HOUSE & DAM.



SECTION THROUGH C-D.



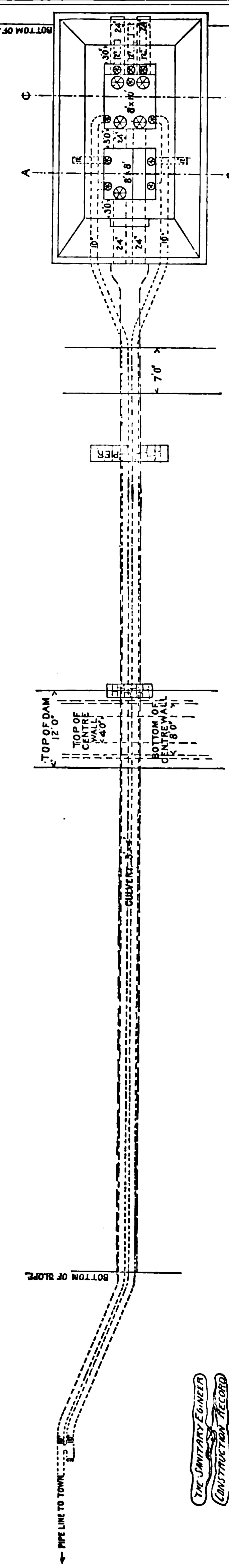
SECTION THROUGH A-B.

THE SANITARY ENGINEER & CONSTRUCTION RECORD

CHARLOTTESVILLE WATER WORKS

CHARLOTTESVILLE WATER WORKS.

1885.



PLAN OF GATE HOUSE.

ently to supply water through the pipe line to the town.

It is 14x27 feet on top the chambers being 8x10 and 8x8, with a 3-foot partition-wall between them, and all the walls are 3 feet wide on top. The dimensions at the bottom are 22x37 feet, the foundations projecting beyond all around. The foundation rests upon very compact rotten rock $7\frac{3}{10}$ feet below the floor of the chambers. To admit water to the chambers, six 12-inch flanged cast-iron pipes are built into the masonry at different heights, each provided with a gate bolted to it to control the flow of water, so that the water may be taken from near the surface where the water is clearer and freer from sediment. Copper wire nettings, secured to plates so arranged that they may be dropped over the inner flange of the gates, form the screens, and have worked very satisfactorily thus far. These can be easily removed and cleaned, as they are light and convenient to handle, and as the pipe opened is always below water they are not liable to collect rubbish or to require frequent cleaning.

The supply-pipes to the town are 10-inch flanged pipe, two to each chamber, each provided with a gate. These pipes are carried through the masonry of the gate-house under the dam through the culvert, and are brought together just beyond the foot of the outer slope into one pipe leading to the town. These are so left that an additional line can be carried to the town when it becomes necessary without disturbing the work in the gate-house or dam.

To empty either chamber, there are two lines of 24-inch pipe, fitted with gates, one line running directly from the first chamber to the waste-culvert, which passes through the dam to the meadow below into the bed of the brook; and the other, from the first chamber into the second, and from the second to the culvert, thus connecting the two chambers, and also allowing the second chamber to be emptied independently of the first.

If it becomes necessary to draw all the water out of the reservoir, the gates on both these 24-inch pipes can be opened and the water will be drawn completely down to the bed of the original brook. The gates used are the ordinary pattern of flanged water-gates, and were furnished by the Coffin Valve Co., of Boston.

At present only a single line of 10-inch cast-iron pipe runs to the town, which is reduced after taking of a 6-inch distribution to an 8-inch pipe along the main street to the farther end of the town. The distribution is made with 6-inch and 4-inch pipes, which are all connected together, with the exception of two lines of 6-inch, where it was not practicable to do so, to insure complete circulation.

There were $5\frac{6}{10}$ miles of 10-inch, $\frac{5}{10}$ mile of 8-inch, $1\frac{8}{10}$ miles of 6-inch, and $1\frac{3}{10}$ miles of 4-inch—a total of $9\frac{3}{10}$ miles of pipe laid. There were also 42 stop-gates, 38 double-nozzle and 7 single-nozzle fire-hydrants set. On the main line to the town, 5 single fire-hydrants were set to serve as air-cocks, and gates were put in about a mile apart, thus dividing up the main line into sections. The gates and hydrants were furnished by the Chapman Valve Co., of Boston, and the pipe and specials by the Warren Foundry and Machine Co., of New York. The work on the dam and reservoir was commenced March 26, 1885, and finished October 27, 1885. It was done under contract by McConnell & Hickler, of Buffalo, N. Y., and cost, including fittings for gate-house, etc., $49,293.99.

The pipe-line was commenced April 6, 1885, and finished early in July. It was contracted for by Trumbull & Cheney, of Boston, and cost, including pipe, gates, and hydrants, $49,475.35. Land damages, right of way, and incidentals brought the grand total up to $107,831.62. For house services 1-inch and ¾-inch tar-coated wrought-iron pipe with lead connections at the main were used.

PAVEMENTS AND STREET RAILROADS.

No. VII.

(Continued from page 485.)

FROM the specifications for paving Wick Avenue in Youngstown, Ohio, with vitrified fire-clay brick, we abstract as follows: The pavement is to consist of vitrified fire-clay brick laid on a foundation of concrete composed of furnace slag, or cinder and sand, with joints filled with hot paving cement or coal-tar. The bricks are to be hard burned and vitrified entirely through, free from cracks, true, and smooth, and are to stand a crushing load of 36,000 pounds on pieces two inches cube. The street is to be excavated 11½ inches below finished surface of pavement, and all soft places made good. The filling in sewer trenches, etc., to be probed with a rod, and where soft to be removed and carefully refilled and rammed. Where ground is wet, agricultural tile-drain to be laid at two feet below finished surface, and carried to nearest catch-basin. The concrete foundation to be six inches thick. The slag or cinder is from Bessemer furnaces, and contains considerable lime, making it almost equal to hydraulic cement. The fresh material is brought while still hot, dumped into a box, and thoroughly mixed with water to make the concrete, and then spread and rammed in the usual way.

On the bed thus made two inches of sand are spread to a uniform thickness by means of guide strips, which are then removed, and the bricks laid in lines crossing the roadway, and so as to break joints by at least three inches. The bricklayers are to stand on the finished work while laying.

The bricks are then to be rammed with a wooden rammer weighing twenty pounds, after which the joints are to be filled with the paving cement heated to at least 300° Fah. This cement to consist of coal-tar pitch and creosote oil. The surface to be covered with sand. All broken bricks to be removed. The contractor to lay at least 300 square yards per day. Then follow the usual requirements as to care of the work, clearing away the rubbish, etc.

A recent report upon the wear of fire-brick pavement in Steubenville, O., shows the wear to have been less than $\frac{1}{16}$-inch annually, but the amount of traffic is not stated. An experiment reported as to absorption shows it to be inappreciable at the end of twelve hours. Fire-brick for this purpose are now manufactured in West Virginia and in Clearfield County, Pennsylvania.

It may not be amiss here to recall the experiments so carefully made nine years ago in St. Louis. These consisted in rolling a two-wheeled cart forward and back over two strips of the pavement to be tested which were each 22 inches wide. The tires were each 2½ inches wide, and loaded to 800 pounds per inch, or two tons total load. The heaviest traffic in St. Louis was 75 tons per day per foot of width, but the average for business streets was 35 tons. Estimating the effect of horses' hoofs at one-third of this, 50 tons per foot was taken as a standard. The total number of revolutions shown by the counter attached to the propelling crank corresponds to the total number of double trips (across the samples and back) borne by the specimens:

If $R =$ number of such revolutions, or $2\,R =$ number of trips,

$L =$ total load in tons on machine,

$W =$ sum of widths of the two samples tested in inches,

$\frac{2\,R \times L}{W} =$ total tons carried per inch of width of specimen,

$\frac{50}{12} =$ tons per *day* per inch width on the streets.

and $\frac{2\,R \times L}{W} \div \frac{50}{12} =$ the number of days equivalent wear on the streets that the specimen has borne.

The samples were weighed before and after testing, and under this load of 800 pounds per inch width of tire, borne for a period equal to eight years and six months on the streets, and 2½ years of about 400 pounds per inch, the total abrasion of the fire-brick pavement was 9 per cent. of its weight, or a depth of ¾ inch. The asphaltum block pavement wore under same traffic 14 per cent., but the bricks in the pavement tested were about one-half of them broken and but one of the asphaltum blocks. Granite blocks after a test equal to eight years and seven months traffic had worn scarcely appreciably, while limestone had lost 10 per cent., and in actual traffic would have lost still more by action of the elements. As a result of all the tests granite blocks were chosen for use on all streets having heavy traffic.

These tests seem to bear out the claims that are made in favor of brick pavements for light traffic.

According to reports large areas of brick pavement have been laid during the past year in Bloomington, Decatur, Jacksonville, and Galesburg, Ill., and experimental sections have been laid in Camden, N. J., and New Orleans.

Mr. George F. Wightman, in a paper before the Illinois Society of Engineers and Surveyors, says: "Brick pavements have been laid which show remarkable qualities of endurance. There are but few localities in which clay has been found that will stand, *without fusing*, the amount of fire necessary to make a brick hard enough for street pavement. Brick in every way suitable have been made at Haydenville, O., Bloomington and Ottawa, Ill. Some of these pavements, although laid ten years ago, present now not only a uniform, but a very smooth surface."

He prescribes the method of laying to be: to excavate ten inches and roll hard, then fill with four inches of sand, on which a course of bricks are laid lengthwise on the flat and so as to break joints, this layer to be tamped, and joints swept full of sand. Then cover with one inch of sand, and place a second course of brick, laying them crosswise and on edge. Sweep the joints full of dry sand and cover one inch thick with sand. This upper course to be burned to a flint hardness.

In the discussion which followed, Mr. Bell exhibited samples of bricks which, after fourteen years' wear at Bloomington, had lost but half an inch in width. He says the brick pavements are the first to dry after a rain. That in Nashville, Tenn., a creosoted brick is in use, so as to make it non-absorbent. The Bloomington pavements are laid with 7-inch crown in 36-foot width between curbs.

Mr. Mead stated that in Wheeling a brick was made of clay and iron slag in the form of a truncated pyramid.

Mr. Wightman gave the preference to a rolled gravel pavement, over either macadam or brick. He would make a lower layer, 6 inches deep at centre and 4 inches at sides, of stone or coarse gravel, from curb to curb, well rolled; then lay on this gutters 3 feet wide of cobble-stone, well rammed, and with spaces filled with fine gravel. The roadbed between to be finished in gravel of ½ to 1½ inches diameter, and enough clay, loam, or sand to make it bind, and thoroughly compacted with a five to six ton roller.

Professor I. O. Baker, in his address, mentioned an experimental section of iron pavement in Chicago; also the experiment in Toledo, of covering unpaved streets with six inches of cinder and ashes.

This covering becomes so compact that in winter heavy loads do not cut through it, and in summer it is less dusty than an ordinary earthen roadway.

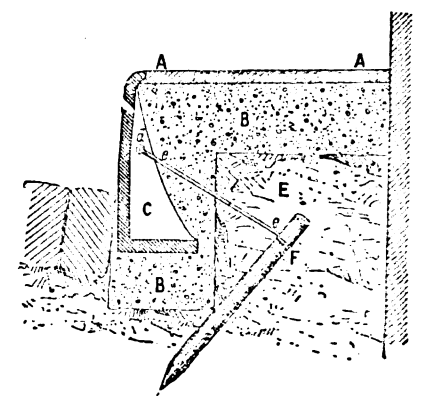


Fig. 1.—

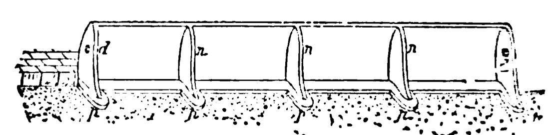
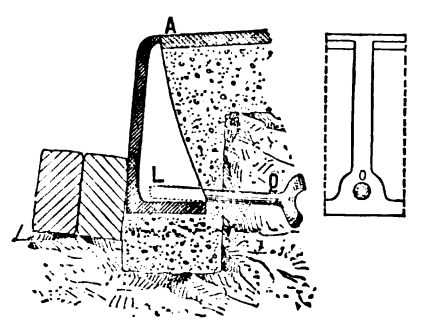


Fig. 2.—



As a matter of interest we reproduce from *La Semaine des Constructeurs* of September 18, a description of a novel form of street-curb, recently introduced at Verdun in France. This application of cast iron is the invention of Mr. Nicot a contractor for asphalt paving, and it is now in use on about two miles of sidewalks. The curb is cast in lengths, as shown in Fig. 2, of an L-shaped section, with ribs or knees, the bearing of the latter being enlarged by an expansion of the bottom flange. The segments rest on a bed of concrete, and the concrete is also filled in upon the bottom flange, as shown in the sections, so that the curb is held firmly in place. The surface of the sidewalk is finished in asphalt to the level of the top of the curb.

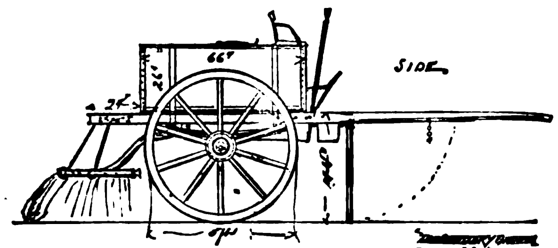
In addition, a peg of wood or iron (Fig. 1) is driven in the earth behind, opposite the end ribs, and secured to the ribs by a galvanized-iron wire. This serves to keep the curb to place while the process of filling is progressing. The reviewer criticises this as smacking too much of the gardener. The suggestion is made that a "fish-tail" rod screwed into an enlargement of the ribs at the joints in the curb, and buried in a small mass of concrete, as shown

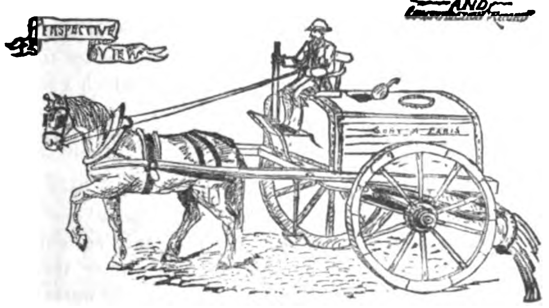
in Fig 3, would be more in accordance with sound ideas of construction.

The reviewer considers the curb as one well worthy of investigation and trial, and we would add that with such improvements as experience may suggest it may be worthy of introduction in localities where good stone for curbs is not obtainable.

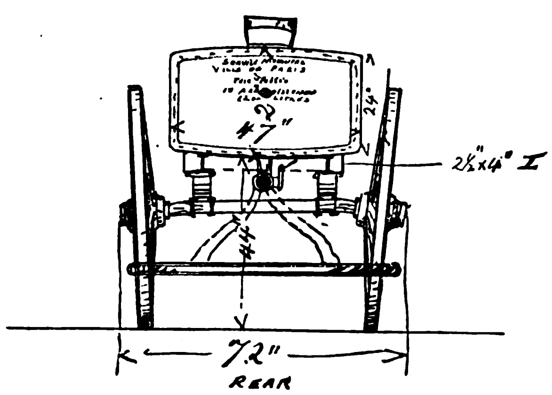
PARIS WATERING-CARTS.

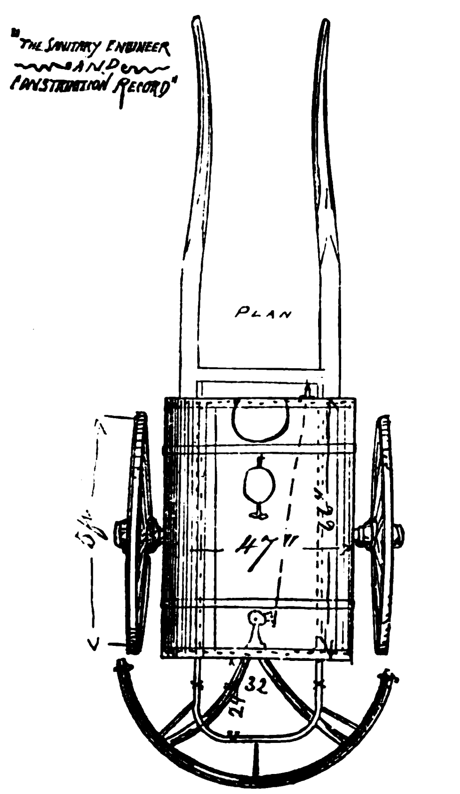
The watering-carts used in the city of Paris and many other towns of France are much less cumbersome than those in use in this country. They are built of sheet-iron, riveted, and painted inside and out. Where salt water is used the iron is galvanized. The usual capacity is 1,200





litres (317 gallons), which a single horse can draw with ease on ordinary level streets, the cart being mounted on a single pair of five-foot wheels. For hilly streets a cart of 800 or 1,000 litres (200 to 260 gallons) is made.





The sprinkler at the rear of the cart is a perforated copper tube, and the holes are set in such a way that the water strikes the ground without raising the clouds of dust which usually surrounds the water-cart hereabout. This is also obviated by the care with which the authorities keep the water-carts going over the same surface several times a day, so as to prevent the burning up of the macadamized surface by the hot sun; the stone pavements are also sprinkled at frequent intervals, instead of flooding them once or twice and rendering the street more muddy on a fine day than after a heavy shower of rain. The accompanying view and plans show the general arrangement. The tank is made fast by iron bands to an iron frame formed by 2½x4-inch I-beams to which are bolted the wooden shafts. This frame projects in the rear for the purpose of carrying a tool-box or a length of leather hose for filling the tank from a sidewalk hydrant.

In the footpaths of parks a smaller cart is made of 150 to 250 litres (40 to 60 gallons) propelled by a single man. The main streets there are also watered and swept immediately after a shower; especially is this the case on asphalt, which becomes slippery just as it is drying off after a smart shower.

SCOOP-WHEELS VERSUS CENTRIFUGAL PUMPS.

In a paper on the drainage of fens and low lands by steam-power, published in a recent number of the *Engineer*, Mr. W. H. Wheeler, C. E., comments as follows:

"The question as to whether the scoop-wheel or centrifugal pump is the better machine for draining land has been much debated, and the matter is still a subject of controversy. The older class of fen enginemen and managers place implicit faith in the scoop-wheel, and believe in it as superior to all other machines. When, however, wheels have been replaced by efficient pumps the result has been so satisfactory that the author has never met with an engineman who would wish to return to the scoop-wheel.

* * * * *

"The question as between scoop-wheels and pumps was some time ago referred by the Dutch Government to a commission, with instructions to report as to the best machine for raising a given quantity of water—in this case 140 tons a minute—to a height varying between 11.3 feet and 12.3 feet, and also at a height varying from 4.9 feet to 13.1 feet. To the first question the commissioners were not able to give an opinion as to whether one form of pump was superior to all others for a high but nearly constant lift. The answer to the second question was decisively in favor of centrifugal pumps, as they found that no other machine applies so well to differences of level in the external and internal water. No other machine permits the application upon so large a scale of the whole disposal motive force to all lifts comprised within the limits stated; and thus while the machine adapted for a maximum lift will with lower lifts discharge larger volumes, the useful effect which is produced by the coal consumed does not vary to any great extent. They therefore recommended centrifugal pumps for both kinds of work. Subsequently, in 1877, Signor Cuppari, an Italian engineer, spent a considerable time in Holland visiting the different pumping-stations and investigating this subject. The conclusion he finally arrived at was that no general rule can be given as to the employment of one or other of the different machines, but that all the circumstances of each case must be considered before a decision is come to as to what machine to use.

"The best hydraulic machine for raising water he found theoretically to be the bucket pump, but that these machines are unsuitable for use for lifting flood water conveying a large amount of *debris*, as they are liable to be damaged and have their valves choked, and experience in Holland had led to the use of centrifugals in their place.

"That the general opinion of Dutch authorities was that in choosing a machine, consideration should be given to the following circumstances and the machine chosen which met these requirements best: the turbidity of the water; the probability of the internal water-level being permanently lowered; the nature of the foundation; the method of establishing communication between the inner and outer water-level, the level at which the machine can be placed with reference to the water to be discharged, the cost of erecting and working. That the centrifugal had the advantage in all these cases, except the first, over all other machines.

"That scoop wheels are efficient machines and the best where there is a large amount of *debris*, and that they have the further advantage that they can be easily repaired by ordinary workmen. The motors for moving them may be of common types, but cannot be used to the best advantage owing to the difficulty of adapting them to the slow velocity required by the wheel. That they further labor under the disadvantage, as compared to centrifugals, of requiring superior foundations. With a high lift the wheel must have a large diameter, the sill must have a low level, and this necessitates massive and deep masonry. That when there is a liability of a permanent lowering of the low-water level wheels, would require costly alteration, whereas with centrifugals additional length can always be added to the piping, and the only difference is that the consumption of steam will be greater. That in regard to the separation between internal and external waters, the easiest and safest arrangement is that of pumps which discharge the water through pipes carried over the banks or inserted in masonry walls of sufficient thickness, thus avoiding the sluices which are required for wheels or screws. That the system of direct action between engine and pump is one that is most economical in fuel; and that the centrifugal pump lends itself most readily for action with this kind of motor. As regards expense, Signor Cuppari gives a table showing the cost of the pumping-stations in Holland during the previous ten years, from which it appears that the average cost per horse-power of water lifted is as follows:

	Building.	Machinery.	Total.
	£	£	£
Scoop-wheels	46.1	46.3	91
Screw pumps	....	....	94
Centrifugal pumps	34.2	36.8	73
Piston pumps	....	....	72

PROJECTED BOSTON PARK IMPROVEMENTS

In the twelfth annual report of the Board of Commissioners of the Department of Public Parks of the city of Boston for the year 1886, Mr. F. Law Olmstead, the landscape architect, submits a plan for the improvement of the lately embanked ground on Charles River. He says: "This ground is near a part of the city occupied by extensive industrial establishments, and having a large tenement-house population.

"It should be an important means of reducing the death-rate at midsummer of infants and young children.

"To all others it is likely to be most useful at nightfall, when the finer beauty of gardens is lost, people coming to it then in great numbers who have been confined during the day in close and heated buildings, streets, and yards.

"Its special sanitary value, both with respect to children and to the class of visitors last mentioned, will be in the broad expanse of tide-water upon which it opens; partly because of the radical change of scene which it will offer from that of the compact town, and partly because of the radical change of air that it may provide.

"It should offer some facilities for open-air exercises for people whose occupations are sedentary.

"The site is one of extreme exposure for plants. Fine garden qualities could only be maintained at a greater cost than in the other public grounds of the city. It is well adapted to the growth of hardy trees.

"Governed by these considerations the leading features of the plan are:

"*First*—A level promenade nearly half a mile in length adjoining and overlooking deep water.

"This promenade is to have an unbroken width of twenty-five feet. It is to be bordered on the side opposite the river by a row of trees, back of which are to be shaded seats, the arrangements being spacious, simple, and convenient for keeping clean and in good order.

"*Second*—On the side of the promenade toward the city the larger part of the ground is to be raised above the general level with slopes of a natural aspect, and is to be planted in the character of a natural grove, screening the air coming from that direction, shutting the buildings out of view, giving a certain degree of sylvan seclusion to the promenade, and smothering the roar of the streets to those upon it.

"*Third*—A space 370x150 feet in extent is to be inclosed and prepared especially as an exercise-ground for women and children, no others being admitted.

"It is to be screened about with shrubbery, and is to be adapted only to simple forms of recreation in which many can be engaged at a time quietly, without compelling care-taking of excessive cost.

"*Fourth*—A space 500x150 feet in extent is to be fitted with simple gymnastic apparatus and subject to use for more robust forms of exercise; but not games or feats likely to attract crowds in which it would be difficult to maintain order and which would interfere with the comfort of women and children on the promenade.'

SEWERAGE OF TAUNTON, MASS.

The Board of Health of the city of Taunton, in its report for 1886, urge that the sewerage of the city is the all-important question for immediate consideration by the city authorities. The present sewers empty into Mill River, a stream running through the business part of the city. In July, August, and Semptember, the volume of the sewage equals that of the water in the stream. It would certainly seem that the warning is by no means premature.

DOMESTIC ENGINEERING
PLUMBING HEATING LIGHTING & VENTILATION

ABOUT WATER-HAMMER.

SIR: Every houseowner and housekeeper should understand what the water-hammer means and how to avoid the consequences, which may be very troublesome.

Most people know what a hammer is when made of iron. Coppersmiths and other mechanics use wooden ones for certain purposes, and call them mallets. If made of oak they are about the same weight as if made of the same bulk of water. Most people know that when anything as heavy as a block of oak is moved rapidly and brought to a stop suddenly it creates a shock or blow, accompanied by more or less noise. The Irishman who fell from a roof said it was "not the fall that hurt him at all, at all," but the "stopping so sudden"; and he was right. There are several ways of avoiding blows, when moving a block of oak and stopping it:

1st. Move it more slowly.

2d. Stop it by a cushion of some kind, like a bag of wool or a rubber bag filled with air.

Now, when water is supplied under pressure in buildings, every one knows that the greater the pressure the faster the water will escape from an open faucet. When so escaping the water in the pipe to which the faucet is attached may be moving at a rate of three or more feet per second. Perhaps that pipe is a branch an inch in diameter, fifty feet long or more, from a large main. If so, the water in it weighs at least fifteen pounds, which, if in a block of oak or iron, would make a heavy maul or sledge-hammer. Certainly fifteen pounds of water is quite as heavy as fifteen pounds of oak or iron, and if either one is moved at the rate of three feet per second and then suddenly stopped, there will be a blow, with such results as generally follow blows. Such a blow with an iron sledge would be likely to break something. Why not, when the moving body is a confined column of water? If the faucet is suddenly closed, the water can't pass by, and will be very likely to burst the pipe in its weakest place, or stretch it if of lead, so that a second or third blow will break it. If of iron, the pipe quivers under the shock and a noise is made.

The remedy is either to diminish the velocity of the water when flowing, or supply a cushion to take the blow, or stop the flow gradually by the operation of closing the faucet.

The velocity depends on the pressure, other things being equal, and if the pressure is inconveniently great—say greater than 43 pounds per inch, corresponding to 100 feet head of water—and faucets are closed suddenly, trouble may ensue. In hilly towns, where the high and low levels are supplied from one source, the pressure may be inconveniently great in the lower streets, and can only be regulated by a mechanical device applied in the mains, called a pressure-regulator, by means of which the pressure in the lower streets can be kept below a certain maximum. In order to apply such a remedy, all the lower part of a town must have such regulators wherever the distributing mains connect with the higher parts. Of course such devices are more or less objectionable, as they break up the simplicity of a system, and are always more or less subject to defects and disarrangements. The person who draws water from a faucet can always avoid the hammer effect if he takes pains to close the faucet deliberately. Compression faucets worked by a screw are used in such cases, because the person who opens them is not likely to close them so suddenly as with the turn-key, or plug-faucet; but compression faucets have their peculiar defects.

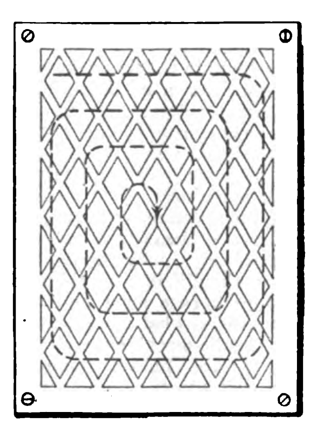
Another remedy for the hammer is found in applying a cushion to take the blow. The simplest form of cushion is an air-chamber in the pipe. Thus in kitchen-sinks the ends of the supply-pipes are turned up above the faucet a foot or two and sealed, so as to contain nothing but air beyond the faucet. This works well at first, but trouble soon follows. Water under pressure has the power of dissolving air just as gas is dissolved in a bottle of beer or soda-water, and soon absorbs the contents of the air-chamber, which then becomes filled with water and the cushion is lost, because water is not, like air,—compressible under ordinary degrees of pressure. The writer has found a remedy for the hammer throughout any part of his house by applying a 3-inch pipe six feet long in his cellar under the kitchen-sink as an air-chamber. It is connected to the water-supply pipe by a short branch with a stop and waste hole in it, and a small bibb or pet cock is inserted in the upper end of the air-chamber. Once in about six months the water-hammer begins to be heard in the kitchen, which signifies that the air in this cushion is all dissolved and water has taken its place. The stop is then closed between the air-chamber and the supply, and the pet-cock opened, to allow the air to enter, when the water drains off at the waste-hole in the stop, after which the pet-cock is closed and the stop opened, and the remedy is complete for another six months. The pressure at this house amounts to eighty-four pounds per inch and makes a good deal of trouble where faucets are handled carelessly without air-chambers near by. EDWARD S. PHILBRICK.

ALLOWANCE FOR FRICTION IN REGISTER OPENINGS.

CHICAGO, ILL., May 3, 1887.

SIR: In your issue of April 30, giving an account of the warming and ventilation of the Honesdale school, I notice in the table of size of registers that a 26x20-inch is taken of the capacity of 3.5 square feet, whereas the actual area of opening of "fret-work" is usually taken as ⅓-inch less 26x20 inches = 520 inches, less 33⅓ inches = 346.32 inches = 2.4 feet. The lineal velocity through this register is given as 305 feet; 305+2.4 gives 43,920 cubic feet per hour, as against 64,020. Please explain if the proper allowance was made for friction or obstructions in the table. Yours respectfully, E. F. KITTEO.

[The engineer who made the measurements of the air in the Honesdale School experiments informs us that it would not be proper to deduct one-third from the area of the registers, as the air velocity was not measured in the holes of the fret-work, but two inches in front of the register face. His method of measuring air-currents at register faces, he explains, is to commence at one corner, and pass the anemometer over the face of the register in a manner as shown by the dotted lines, reaching the centre in about a half a minute, then returning over the same course, reaching the corner again at the end of the minute as nearly as possible. Should the corner be reached before the minute was called, he would make a few oblique movements across the register face.



REGISTER

The registers used were Persian pattern, and consequently very open in the face; but even if they were asylum patterns—strong and close—it would be improper to deduct one-third from the flow of air when measured two or three inches from the face of the register.

When register faces are removed from the frames, and the velocity measured in the opening, then a large allowance must be made for the obstruction of the fret-work, but as this allowance would be different with every different pattern of register face, the error will be much less if the air is measured with the face on.

The distance of the anemometer from the face of the register is not very important, except that it must not be so far from it that air-currents can spread, and lose their velocity, before they reach it. If the anemometer was not kept in motion, as explained before, then it might be possible to get too high a reading by having a jet of air through a hole in the fret-work strike the blades; but while it is in motion it is the average effect only which reaches it, and by keeping it two or three inches from the face, the stream of air 20x26 inches at the recorded velocity is registered.]

MOULD SYSTEM AND ELLIS SYSTEM OF STEAM-HEATING.

NEW YORK, May 11, 1887.

SIR: In a recent issue of your valuable journal I noticed the publication of steam-heating bids, or tenders—in Michigan or Minnesota, I think—and among them I find the systems referred to were, 1st, the "Mould System," 2d, the "Ellis System." Can you give me any information in regard to those systems? Have you ever published descriptions of them? If so, and you would kindly refer me to them, I should feel obliged to you, "Steam-Heating Problems" contains no reference to them.

Yours very truly, C. POWELL KARR, C. E.,
Consulting Arch., Room 217, Stewart Building.

[We publish the bids in our Contracting News columns. We have not illustrated the systems mentioned, nor do we know what they are.]

KITCHEN BOILER CIRCULATION.

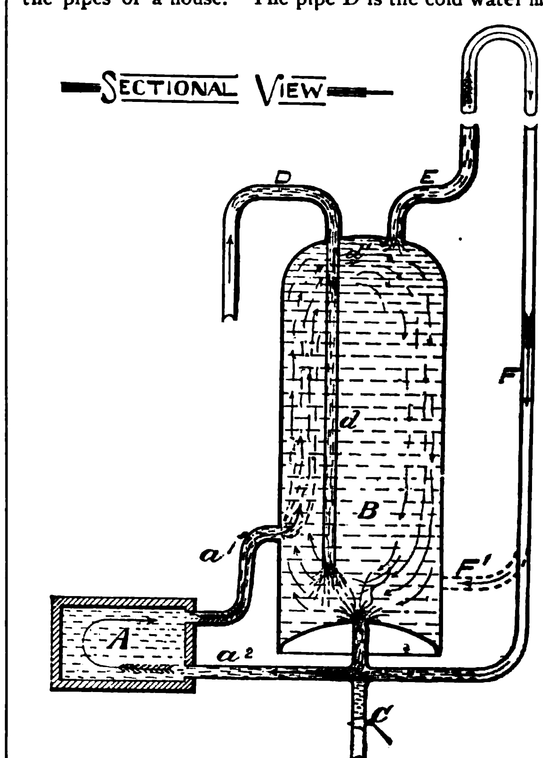
HARTFORD, CONN., March 22, 1887.

SIR: Please make a sectional diagram of an ordinary house hot-water boiler, showing how the water enters, heats, circulates, and finally leaves the boiler; also, location of sediment-cocks and wash-out plugs, etc., and please give text descriptive of same. DRAUGHTSMAN.

[The accompanying sketch shows an ordinary kitchen or domestic boiler (B) with water-back A.

The water-back is the heater. The pipe a^1 is the pipe through which the hot water flows from the heater to the "boiler." The pipe a^2 is the one through which a return flow takes place. The "boiler" (B) is the reservoir for hot water, and together A and B make up the apparatus for producing hot water in private houses, etc.

The interchange of water between the water-back and the boiler is maintained through the pipes a^1 and a^2 as shown by the arrows, and the power of this current has nothing to do with the movement of the water through the pipes of a house. The pipe D is the cold water inlet



to the boiler, and the pipe d is a continuation of it which runs down within the boiler so as to carry the cold water well down before it begins to mix with the water already in the boiler. It has a small hole near the top, as shown (d'), to prevent the water being syphoned out or backing out of the boiler and into the main when water is being drawn off outside.

The pipe E is the hot-water flow-pipe to the faucets throughout the house. Often there is no return-pipe F, but in a complete apparatus there is. The water flows out at E and returns through F into the bottom of the boiler through a connection, as shown, and sometimes it may be found to enter at the side as in F^1.

The circulation of the water through E and F depends on its relative weight for equal heights in the two pipes.

When F enters at the bottom, as shown, the water from the house circuit usually goes through the water-back. The sediment-cock is at C.

Many illustrations of kitchen boilers variously fitted up, showing circulation, are to be found in "Plumbing and House-Drainage Problems," published by THE SANITARY ENGINEER AND CONSTRUCTION RECORD. Sold by Book Department at $2.]

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

IMPROPER LAYING AND MAINTENANCE OF PAVEMENTS.

BOSTON, April 23, 1887.

SIR: I desire to call attention to the asphalt pavement on Columbus Avenue. This is the principal piece of asphalt in Boston, I believe, and was laid only about three years ago. But it shows what result may be expected from improper laying and caring for road-bed surfaces. There is a double line of horse cartracks down the middle of this street, thus dividing the surface in two strips of asphalt separated by a strip of stone-block pavement. Now, instead of protecting each side of the track by block pavement to the full width of gauge of large trucks, the block extends only about 20 inches on one side (the north-west) and from 4 to 8 inches on the south-east (that is, one header and one stretcher). The consequence is that the asphalt is all worn and rotted down next to the track on the south-east side for a width of 14 to 16 inches, and on the north-west side about the width of a wheel-tire, the marks of the heavy truck wheels measuring seven feet out from the edge of the inside rail of track on each side. Now, if the pavement of stone blocks had been carefully laid out to the full width of seven feet from inside rail, and laid on a solid concrete foundation, so as to support the outer wheel of the heavy truck while the other wheel was running in the groove of the inside, the asphalt would have worn as evenly next to the pavement as farther away from it. Just at present these worn ruts, some 2 to 4 inches deep on the south-east side of the track, are being *repaired*. That is, the asphalt is cut out in sections, and the hole filled with *cement concrete* to the level of the old asphalt. No repairs have been made on the general surface, and it presents lots of cradle holes, which should have been cut out and relaid as soon as they appeared; then, in many places the gutter is all worn down and is a mass of wet, pasty substance, frequently extending out in patches six or eight feet from sidewalk, thus destroying the quality of the surface. It is this kind of carelessness in regard to asphalt (or any other pavement) which brings it in disrepute, and really increases the cost of an already costly pavement, as its life is shortened by one-half or two-thirds by lack of judicious care in keeping it in repair.

The avenue is sufficiently wide to allow of all of one side of the tracks being laid, in sections, at one job; then the other side for the whole length of street, and thus the new surface would, when put in use, receive equal wear, which does not happen when the surface is laid in sections on opposite sides of street. If restrictions are put on to the width of stone pavement each side of track by horse railroad company or by the city, any reputable firm ought to refuse to lay their pavement in such unpromising and unfavorable conditions, and should see to it that the wheels of heavy trucks running in the groove of one of the rails should not extend on to the asphalt surface, which has less resistance than the rail surface, and will therefore be quickly destroyed by this constant wear in the same rut.

Y. D. S.

HOW TO TAKE QUANTITIES AND ESTIMATE COST OF CONSTRUCTION FROM BUILDING PLANS.

PHILADELPHIA, April 27, 1887.

SIR: Will you be kind enough to inform me what would be the best books for me to get for the following instruction? I am about to go into the employ of a contractor, and I am very anxious to know the full detail of building as per plans, etc.; how to go about taking measurements and to make calculations for the different materials that are to be used, etc. Yours, etc., C. S. F.

[The principal object desired by C. S. F. is evidently to make calculations and measurements of the various materials required by contractors in estimating.

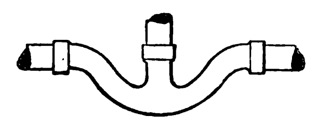
As it is impossible for any one to take out quantities and make measurements without a knowledge of building construction, the first thing to be done is to make himself acquainted with this subject, and for the attainment of this end, we would recommend as text-books for him to study, "The Architect and Builder's Pocket Books," by Frank E. Kidder, C. E., Consulting Architect, Boston; "Building Superintendence," by T. M. Clark, F. A. I. A.; and "Notes on Building Construction," published to meet the requirements of the Committee of Council on Education, South Kensington, London. The study of these, together with the constant examination of good practical examples, will give him the necessary knowledge of construction.

One of the best books on taking out quantities or making measurements for contractors is "Fletcher's Quantities," published by Batsford, of London, England. It contains practical examples of measuring stone-work, brick-work, carpenter's work, iron-work, etc., in all their details—more details than needed in this country, but necessary to a thorough understanding of the subject. In practice, however, the student can easily omit what he deems superfluous, or make changes to suit the customs here.]

GAS EXPLOSION IN A DRAIN.

LONDON, March, 1887.

SIR: Some few weeks ago when searching for a cause of smells in a gentleman's house in the north of London, it was found necessary to remove the paving in the scullery. On removing some earth with the object of digging down to the drain, the end of a drain-pipe was found, and a disk of wood placed in the socket. The bricklayer removed the disk of wood and held a candle so that he could look down the pipe so as to form an idea as to why the drain-pipe was there, and so imperfect a protection made against the escape of bad air from the drains. The lighted candle was just being held in the position when a dreadful



bang occurred and flames shot up about four feet above the level of the flooring. After the first bang had occurred a pale blue light flickered in the pipe, and gradually burnt lower and lower until it reached the bottom, when it went out, this taking some seven to nine seconds, as near as could be judged under the excitement of the time. The bricklayer's hand and face was slightly scorched, and the writer was a little astonished for the first few seconds. Afterwards digging down to find the drain, the form of trap was found to be as shown in sketch. At the bottom of the pipe was an accumulation of black, greasy, offensive-smelling matter, which, on decomposing, had given off the gases which exploded. Yours truly, J. W. CLARKE.

[This form of trap on a main drain is an obstruction and not self-cleansing. The water-line of a trap should always be below the lower line of junction with house-drain.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
May 14......... ..	26 08	20.34	23 36	29.39	28.47	26.13	30.79

E. G. LOVE, Ph.D., *Gas Examiner.*

NEW YORK CENTRAL RAILROAD COMPANY is experimenting on the electric-lighting of railroad-cars. The Kookogay system is now on trial.

A NATURAL-GAS celebration will be held in Findlay, O., from June 9 to June 11.

THE Massachusetts Gas Commission, after investigation of the complaint of certain citizens that the quality of the gas furnished by the Worcester Gas-Light Company was inferior, and the price excessive, has recommended that after July 1 of this year the price be $1.50 per 1,000 cubic feet, and that additional mains be laid in certain parts of the city.

THE Western Gas-Light Association met in St. Louis May 11 and 12, and elected the following officers for the ensuing year: President, Emerson McMillin, of Columbus, O.; First Vice-President, George T. Ramsell, of Vincennes, Ind.; Second Vice-President, E. J. King, of Jacksonville, Ill.; Secretary and Treasurer, A. W. Littleton, of Quincy, Ill. The next convention will meet in Chicago in May, 1888.

DISASTER IN SCHOOL BUILDING PREVENTED.

"LOWELL, MASS., December 22.—John Cochrane, janitor of the new Weld Primary School building, was startled this morning to find that there was not a drop of water in the boilers connected with the steam-heating apparatus. The situation was critical; for the furnace fires had been left burning over night, and the hundreds of school children were gathering in the building He carefully let on the water a:d a terrific explosion was averted. Mr. Cochrane was completely unnerved after the danger was over. Investigation showed that some person had gained entrance into the building by smashing in a window and had opened the faucet in the exhaust pipe of the boiler, allowing all the water to run into the sewer. The perpetrator of the deed is unknown; and the only motive that can be assigned is that some unsuccessful candidate for the place of janitor of the school-house—and there were many—took this means to revenge himself upon Mr. Cochrane."

The above clipping from a daily paper contains a curious admixture of tragedy, comedy, and ignorance. The tragic part lies in the attempt to ruin the boiler and perhaps kill or injure some of the occupants of the building, all for the sake of gratifying a petty spirit of revenge; and shows to what depths of meanness anything in the nature of political aspirations will bring a man. The comic part lies in the graphic description of Mr. Cochrane's "nerveless" condition after he had averted (?) the danger by turning water into the boiler when it was empty and the fires were burning. The ignorance belongs wholly to the aforesaid Cochrane. Any man who don't know better than to let water into an empty boiler, under such circumstances, ought never to have anything to do with them. Accidents are liable to happen at any time, by which a boiler may become empty, and if a person don't know enough to haul a fire instead of doing the very thing that, above all else, causes trouble if there was a possibility of it, his party services should be rewarded with the gift of some office where his ignorance will not endanger the lives of innocent children. The Council or Board of Aldermen is the prope place for such talent.—*The Locomotive.*

THE PLUMBER AND SANITARY HOUSES.

THE fourth edition of this valuable work on house-drainage and plumbing by S. Stevens Hellyer, of London, has just been issued. The author has also been complimented by having his work translated into the French language under the patronage of La Chambre Syndicate des Entrepreneurs de Plombre de la Ville de Paris, it being published by MM. Andre, Daly Fils & Cie., 51 Rue des Ecoles, Paris.

PHILADELPHIA MASTER PLUMBERS' ASSOCIATION.

THE Master Plumbers' Association, at their meeting on May 12, elected William E. Lindsley President for the remainder of the year's term. A resolution was adopted and ordered sent to the Board of Health, asking the Board to enforce Rule 4 of the rules and regulations providing that the architects shall in the future prepare the plans of all plumbing-work and have same approved by the board before submitting to plumbers for proposals. A like resolution had been adopted at the April meeting, but was ordered to be submitted to the Philadelphia Chapter of Architects, but the latter organization declined to approve.

The trade school connected with the Master Plumbers' Association, composed of the apprentices of the members, has been closed for the season. The final exercises have not yet been held. During the season there were twenty-eight boys in attendance. Two sessions were held each week on Tuesdays and Fridays; on the former instruction in drawing, with special reference to drawing of plans suitable for plumbing work, was given, and Fridays were devoted to shop practice.

VERMONT STATE BOARD OF HEALTH ACT.

No. 93.—An act to prevent the spreading of contagious diseases and to establish a State Board of Health.

It is hereby enacted, etc.:

SECTION 1. The Governor, by and with the advice and consent of the Senate, shall appoint three persons as members of a State Board of Health for the State of Vermont. The term of office of said members of said board shall be so arranged that the term of one of them shall expire at the end of every second year. Vacancies in said board shall be filled as they occur by appointment of the Governor, and confirmation of the Senate when next in session.

SEC. 2. The members of said board first named in said appointment shall call a meeting of said members immediately after notice of said appointment shall be received

by said members, and said board shall meet within six days after said notice, at the time and place designated in said call, and said board shall organize by electing one of their number to be president of said board, and the board shall also appoint a secretary, who shall a be reputable practicing physician of this State, and if not one of the members of said board by appointment he shall be a member of the board by virtue of his appointment of secretary. The said secretary shall hold his office until said board shall appoint another secretary, and he shall be the executive officer of said Board of Health.

SEC. 3. The board shall take cognizance of the interests of life and health among the inhabitants of the State; shall make or cause to be made sanitary investigations and inquiries respecting causes of disease, especially of epidemics, and the means of prevention; the sources of mortality, and the effect of localities, employments, habits, and circumstances of life on the public health. They shall also, when requested, or when in their opinion the sanitary interests of localities require it, advise with municipal officers with regard to location, drainage, water-supply, heating and ventilation of public buildings, and the drainage and sewerage of towns and cities.

SEC. 4. The board shall meet biennially on the second Tuesday of the session of the Legislature at Montpelier, and at such other times and places as in the judgment of the board the public health may require, and also whenever the public safety of the people, or the stock and domestic animals of the State shall require. The secretary, as executive officer of the board, shall superintend the performance of the work prescribed in this act, and shall perform such other duties as the board shall direct. He shall also respond to the invitations of boards of selectmen of the several towns, or the mayor of a city, in case of epidemics, contagious diseases, or other unusual sickness, by visiting the locality, or in such other way as may be deemed best; he shall render the Secretary of State any necessary assistance in preparing for publication the annual registration reports required by law relating to births, deaths, and marriages in the State, and he shall make report to the Governor on or before the first day in September in each year of the investigations, discoveries, and recommendations of the board, which report shall be printed and distributed as soon as practicable thereafter in the same manner as other public documents of the State.

SEC. 5. The compensation of members of the board shall be five dollars per day and actual expenses while in discharge of their official duties, and the Governor and Auditor of accounts may allow to the secretary of said board such additional sums for services as secretary or for services in times of extraordinary peril as seem to them reasonable, provided the whole expense of the board including the secretary, for services rendered and all expenses incurred shall not exceed in any year fifteen hundred dollars, except in some extraordinary public peril, in which case the Governor may order said board to do and perform service for the safety of the State and her people in excess of said sum, but never to exceed the sum of twenty-five hundred dollars in all in any one year.

SEC. 6. This board shall have authority to promulgate and enforce such regulations for the better preservation of the public health in contagious and epidemic diseases as they shall judge necessary; and any person or persons or corporation neglecting or refusing, after having been duly notified in writing, to comply with the requirements of such regulations shall, upon conviction thereof, pay to the treasurer of the State a fine of not less than twenty-five dollars nor more than one hundred dollars, said offense to be prosecuted for before any court of competent jurisdiction in the State.

SEC. 7. This act shall take effect from its passage.

Approved November 23, 1886.

NEW YORK TERMINUS OF BROOKLYN BRIDGE.

THE Brooklyn Bridge Trustees have adopted a plan for the bridge terminus in this city that was submitted to them by Trustees Clarke and McDonald, which plan was prepared by Charles E. Emery, C. E., of this city.

The plan provides that the promenade shall be continued from the stairway at the New York anchorage by an iron trestle about fifteen feet above the level of the cable road, through the centre of the bridge house, to a platform from which the street can be reached by a double staircase. The promenade entrance will be about 36 feet above the street, and about level with the top of the elevated railroad station. The present entrance to the promenade will have a broad stairway leading to a platform between the tracks, 19 feet wide and about 350 feet long, for the use of outgoing passengers. The parallel of the tracks inside the bridge house will be continued only to the eastern side of Park Row, and the tracks across the street are to be removed to supply platform and stairway room.

The plan contemplates doing away with switch engines entirely by putting in duplicate tracks and duplicate cables, one set of which will turn off from the north to the south track about 600 feet east of the end of the road. Every alternate train will be run upon this track, and discharge its passengers upon the outside platform on the south side of the station. Trains on the other track are to run directly into the station as at present, and discharge their passengers upon the outside platform on the north side; both trains loading from the centre platform, that on the south track will proceed directly across the bridge, while the other will cross to the south side by its own cable east of the station. By this scheme only one set of switches will be required.

Mr. McDonald stated that as the plans had been prepared by Mr. Emery, and were not complete, they desired leave to employ Mr. Emery as consulting engineer. The board authorized the committee to employ Mr. Emery to assist in elaborating the plans and preparing working specifications, all of which are to be submitted to Bridge Engineer Martin, under whose supervision the work is to be done.

All but the duplicate tracks and cables part of this plan was submitted to the board by Mr. F. Collingwood, C. E., in 1881, and rejected. Mr. Collingwood designed and superintended the construction of the New York station of the bridge. His plan contemplated the elevated promenade, the switching east of the station, and the central and outside platforms for passengers. It was at that time rejected.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

AT the meeting of the Society held on Wednesday evening, May 18, President William E. Worthen in the chair, a paper by Professor A. J. DuBois, Jun. Am. Soc. C. E., was presented and read by John Bogart, Secretary. Written discussions on Professor DuBois' paper were presented by the following gentlemen, and also read by the Secretary:

By members—J. A. Le Waddell, A. Gottlieb, C. J. Morse, H. C. Jennings, Edwin Thatcher, William M. Hughes, George H. Pegram, and also by Henry B. Seamen, Jr., and P. C. Ricketts, associate.

A review of the written discussion was presented by Professor DuBois, which closed the discussion.

BOSTON SOCIETY OF CIVIL ENGINEERS.

THE Boston Society of Civil Engineers held their monthly meeting in their rooms, in B. & A. R. R. depot, May 18, at 7:30 P. M. Forty-three members and nine visitors were present. Mr. S. E. Tinkham was elected Secretary, vice H. L. Eaton resigned. An illustrated paper on "Woods," their structure, decay, and preservation, was read by Mr. P. H. Dudley.

During the month of April the exports of petroleum products from the United States were as follows: Crude mineral oil, 4,237,518 gallons, valued at $269,439; naphthas, 651,435 gallons, valued at $55,805; illuminating oil, 33,732,906 gallons, at $2,555,386; lubricating and paraffine oils, 1,545,071 gallons, at $281,669; residuum, 853,356 gallons, at $38,804; total 41,020,346 gallons, valued at $3,201,103. For April 1886, the totals were, 42,074,701 gallons, and $3,533,371.

THE Supreme Court, in a decision just sent down in the cases of S. P. Train *vs.* the Boston Disinfecting Co., says the Board of Health of Boston has the right to make the regulation that rags brought from a foreign port shall be disinfected, and that the board has the right to impose the expense thereof on the plaintiff, and to subject the rags to a lien therefor.—*Worcester Gazette.*

AN interesting work has been published for the Baltimore and Ohio Railroad Company by Dr. W. T. Barnard, assistant to the President of the Baltimore and Ohio Railroad Company, on "Technical Education in Industrial Pursuits," with special reference to railroad service.

THE Iowa State Board of Health has passed a resolution requesting the railroad companies to change their water coolers from the present close connection with the water-closet to some other part of the car; and, further, that the axes and saws now kept inside the ends of coaches be removed to some more accessible part of the car.

PERSONAL.

EDWARD T. WHEELER, architect, of Baltimore, while suffering from melancholia, committed suicide in that city, last Saturday. He was only 28 years of age.

DR. DANIEL G. BRINTON, who has been for a number of years editor and publisher of the *Medical and Surgical Reporter*, and the *Quarterly Compendium of Medical Science*, severed his connection with those journals on the 1st of May, 1887.

J. ROGERS MAXWELL, of the Long Island Railroad, has been chosen President of the New Jersey Central Railroad.

J. F. HOLLOWAY, for many years President and General Manager of the Cuyahoga Steam Furnace Company, of Cleveland, O., has accepted a position with the firm of Henry R. Worthington, and will hereafter reside in New York City.

BUILDING INTELLGENCE.

(Continued on page 637.)

BRADFORD, CONN.—A new railroad depot will be built here.

BALTIMORE, MD.—A $300,000 hotel will be built on Charles and Eagen Streets. A. L. Garter is interested.

ALBANY, N. Y.—The Odd Fellows will purchase and enlarge the Wendell Building on North Pearl Street.

BALCONY FALLS, VA.—Address Col A S Buford, of the Balcony Falls Company, about extensive improvements here, including buildings, iron furnaces, etc.

CLEVELAND, O.—Waldemar Otis, will build a theatre on Euclid Avenue and Vincent Street.

BOSTON, MASS.—The aldermen have in consideration an appropriation of $18,000 to enlarge the City Hospital.

ORANGE, N. J.—Plans have been drawn for a new laboratory here for Thomas A Edison, electrician. It will be of brick, 3-stories, and 60'x250' in plan.

BOSTON, MASS.—Mr. John W. Farwell and Mr. Wm. I. Kennedy, are to build extensive houses on Howland Street.

Norcross Bros. have signed contracts for the new houses for the Algonquin Club, on Commonwealth Avenue.

CAMBRIDGE, MASS.—Mr. Frank Henderson, of the firm of Henderson Bros., has purchased the old Teele estate on North avenue, Cambridge. It is Mr. Henderson's purpose to lay out a number of streets on the estate and build some one hundred houses.

XENIA, O.—A new union depot will be built here.

YOUNGSTOWN, O.—Plans have been made for the enlargement of the Welsh Congregational Church.

OAKLAND, CAL.—The Baptist Church will be built here this season.

SOUTH BEND, IND.—Plans were completed recently for a Presbyterian church.

PHILADELPHIA, PA.—The Girard Insurance, Life and Trust Company has purchased buildings, corner of Broad and Chestnut Streets, for $109,000, which will be torn down and costly structures erected.

DUBUQUE, IA.—A movement is on foot to build a new union depot.

ALBANY, N. Y.—Mr. B. Sherman will build a 4-story building on North Pearl and Steuben Street, to cost $17,000. Plans are by Fuller & Wheeler.

BALTIMORE, MD.—Gilmor nr Mosher, 21 3-story br bldgs; o, Jno C Parker.

Lafayette nr Gilmor, 4 5-story br bldgs; o, Jno C Parker.

Read e of Calvert st, 4 3-story br bldgs; o, A D Michall.

Bond st nr Bank, 4 3 story br bldg; o, T Cook.

Dallas st nr Bank, 5 3-story br bldg; o, T Cook.

Park ave, beg at Worth,'11 3-story br blds; o, W L Stork.

S Charles and Barre sts, a 7-story br warehouse; o, Morbury Bros; a, Chas L Carson; b, Chas Markland.

MINNEAPOLIS, MINN.—1808 First av S., 2-story br dwell; cost, $9 000; o, A R Miller.

67 Twelfth st S., 3-story br dwell; cost, $14,000; o, Perry Harrison.

Tenth av S., bet 5th and 6th sts, 2-story br dwell; cost, $15,000; o, Foster & Smith.

Girard av, cor W Lake st, 2-story br school bldg; cost, $19,000; o, Board of Education.

Cor 2½ st and 20th av S, 2-story br school bldg; cost, $19,000; o, same as above.

Fourth av S., bet 11th and 12th sts, N. E., 2-story br school bldg; cost, $40,000.

Cor Union av and 56th st N. E., 2-story br school bldg; cost, $18,000; o, same as above.

W s Taylor st, bet 24th and 25th sts N. E., addition to school bldg; cost, $10,000; o, same as above.

32d av, bet Emerson and Fremont avs N., 2-story br school bldg; cost, $14,000; o, same as above.

Fifth av S., bet 5th and 6th sts, 2-story br school bldg; cost, $15,000; o, same as above.

PROVIDENCE, R. I.—Charles, Admiral and Oriental, br Enginehouse; o, Prov & Wor R R; b, W A Chapman & Co.

23 permits less than $7,000.

HEMPSTEAD, L. I.—A three-story br school-house is to be erected here at a cost of $30,000. The dimensions will be 90x38, with an extension 45x67. The building will belong to the village. Th Engelhardt is the architect.

GROTON, CONN.—Mr Charles Bard, of this place, is to erect a two-story summer cottage here to cost about $7,000. Dimensions, 35x50. Architects, Palliser, Palliser & Co.

ASTORIA, L. I.—Architect William Kuhles has prepared plans for a two-story br factory for a New York chemical company. Dimensions of building, 50x86. Cost, $25,000.

ST. LOUIS, MO.—Grand and Lindell avs, br dwell; cost, $20,000; o, J D McLure; a, Eames & Young; b, F S Greene.

Washington and Sarah avs, br dwell; cost, $15,000; o, D Hauser; a, C C Hellmers; b, C Gerhard & Son.

Washington and Sarah avs, br dwell; cost, $15,000; o, Miss L Hauser; a, C C Hellmers; b, C Gerhard & Son.

Jefferson and Cherokee sts, b, br flats; cost, $7,500; o, Mrs E Gresse; a, Capitain & Steinman; b, sub let.

Fourteenth st and Clark av, 4 add br dwells; cost, $8,000; o, William Renshaw; a, Capitain & Steinman; b, sub let.

Pestalozzi and Menard sts, br bldg; cost, $10,000; o, Anhauser & Bush; a, E Jungenfeld; b, sub let.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

CONTRACTING INTELLIGENCE

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." ***Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.***

For works for which proposals are requested, see also the "Proposal Column," pages 650-651-652.

WATER, SEWERAGE, ETC.

VICKSBURG, MICH.—On May 23 a special election will be held to decide whether or not the village will bond itself in $10,000 for water-works.

MAPLEWOOD PARK, MINN., will have a supply of water.

FOND DU LAC, WIS., will immediately extend its sewerage system.

OSHKOSH, WIS., is experimenting to determine whether it will need filters for the water-supply.

PAINESVILLE, O., will have a system of sewers.

GREENVILLE, MISS., has granted a franchise to New Orleans parties giving them authority to build water-works.

WARREN, O., water-works, with 12 miles of mains and 105 hydrants, have been tested and pronounced satisfactory. The annual rental is $4,500.

ALLENTOWN, PA., is discussing the question of moving its pumping-station and acquiring a new plant. The cost is estimated at about $50,000. City Engineer has received estimates from various parties.

PORTSMOUTH, VA.—The new water company has organized with Lebbeus B. Ward, of Jersey City, N. J., for President; C. D. Ward, of Oswego, N. Y., Vice-President; Isaac Peck, of Flushing, N. Y., Secretary and Treasurer.

TOLEDO, O.—Colonel Lemert, of Bucyrus, has made a proposition to purchase the water-works plant from the city. His plan is to erect water-works on Lake Erie and to pipe the water to Bowling Green, Fremont, Fostoria, and other small towns in north-western Ohio.

JAMESTOWN, N. Y., is considering the construction of sewers. Mayor Price can give information.

CARLYLE, ILL.—A set of Hyatt filters will be erected here. The Pond Engineering Company, of St. Louis, is building the water-works.

SEDALIA, MO.—The Inter-State Gas and Water-Works Company, of St. Louis, have bought the water-works at $100,000.

DOVER, N. J., will have] a water-supply from Mayor Richard's place.

JANESVILLE, WIS.—The contract for building the water-works has been awarded to Turner, Clark & Rawson, of Boston. They will lay 13 miles of pipe and will furnish 180 fire-hydrants at $4,200 per annum. There will be pumping engines with a daily capacity of 4,000,000 gallons, and a stand-pipe 25 feet in diameter and 175 feet high.

BENNINGTON, N. Y., has contracted with the water-company to take 50 hydrants at $20 each annually.

WESTBROOK, ME.—The Portland Water Company has made a proposition to supply this town with water.

MILTON, ONT., has received a proposition from certain parties to put in water-works at $76,000.

SYRACUSE, N. Y.—The Syracuse and Salmon River Water Company, William A. Sweet and others, of Syracuse, projectors, has applied for a franchise authorizing the company to furnish water from the Salmon River. The company agrees to furnish water enough for 500,000 people, giving each 60 gallons per day; the city to take 10 hydrants for each mile of pipe, paying $47 per annum for each hydrant.

WESTFIELD, N. Y., has appointed a committee to take measures to obtain a water-supply.

PRESQUE ISLE, ME.—Organized is the Presque Isle Water Company, A. W. Forbes, President.

EUREKA, CAL., will extend its works. H. L. Ricks is superintendent.

MCKINNEY TEX.—Incorporated is the McKinney Water-Supply Company, by J. L. Daggett, D. F. Garrish, H. A. McDonald, Jr., and others.

WEST CONCORD.—Goodhue & Birnie, of Springfield, Mass., have begun work on the water-works extension to this place.

BEAUMONT, TEX.—We last week noted that this town would have water-works. The directors are W. A. Fletcher, V. Weiss, H. Solensky, J. L. Keith, J. J. Crichton.

LOWELL, MASS.—The Aldermen have voted to raise $70,000 for sewer extensions.

CHATTANOOGA, TENN.—Twelve Hyatt filters will be placed at the new pumping station at Citico. New mains will be laid and other improvements made, costing $100,000. W. S. Kuhn is general manager.

MIDDLETOWN, N. Y.—Mr. James T. Gardiner has made a report on the sewerage, recommending the separate system.

NEW BEDFORD, MASS.—The Council has just decided to appropriate $16,000 for the extension of the Willis and Pearl Street sewers. Mr. A. B. Drake is the City Engineer.

COVINGTON, KY.—The Trustees have finally selected the site for the three new reservoirs, and they will be built. Their total capacity will be 90,000,000 gallons. The Cincinnati and Newport Iron and Pipe Company has the contract for the iron main. A pumping-station will be established.

GREENBUSH, N. Y.—A bill is now before the State Legislature giving authority to the town to raise funds for a system of sewerage.

ASHBURNHAM, MASS.—This town wants water and a special town meeting will be held to consider it.

SAN JOSE.—At a special election May 6, on the question of the issue of $500,000 bonds by the city, for the purpose of building a city hall, building sewers, bridges, etc., proposition was decided in favor of the bonds by an overwhelming majority.

ELMIRA, N. Y.—A bill is before the State Legislature authorizing the city to expend $45,000 on a system of sewers.

LE MARS, IOWA.—Water-works will be built here.

CHATTANOOGA, TENN.—A contract has just been signed with the City Water Co. for building an extension to its works so as to supply St. Elmo with water.

ONEONTA, N. Y.—Sherman & McDonough, of West Troy, have the contract for building the reservoir of the Oneonta Water-Works at $24,900, with 1,000 extra for removing stumps, etc., within the water-line.

MOBILE, ALA.—The contract for dredging out the mouth of the new basin at New Orleans has been given to Rittenhouse Moore of this city.

PLYMOUTH, MASS., has a bill reported favorably in the State Legislature granting authority to construct sewers.

WATER COMPANY.—The Consolidated Water-Supply Company, capital $5,000,000, has been incorporated in New Jersey. A. N. Turner, G. H. Lyman, and F. M. Wheeler, of Jersey City, are incorporators.

WARREN, O.—The City Council, on May 15, voted to accept the water-works constructed by Samuel R. Bullock & Co., of New York City. The terms of contract give the city the right to purchase the works.

MARSHALL, MO., will have a system of sewers.

ARGO, IOWA.—Water-works are being discussed here.

MAYVILLE, DAK.—Artesian wells will be sunk here.

WATER.—A better supply is wanted for Winchenden, Mass.

TAYLOR, TEX.—$80,000 will be expended by the water company on works here.

BINGHAMTON, N. Y., wants to substitute iron pipe for cement-lined pipe at a cost of $12,464.

NEW WATER-WORKS.—It is reported that new water-works are to be established as follows: DeArmanville, Ala., address Dr. A. M. Buckalew, Eden, Ala.; Johnson City, Tenn.; Wytheville, Va.; Ridgedale, Chattanooga P. O., Tenn., address Ridgedale Water Co.

GAS, STEAM, BUILDINGS, ETC.

WYTHEVILLE, VA.—The town has voted to appropriate $6,000 to obtain electric-lights for the streets. Works will soon be built.

VINTON, IOWA.—Incorporated is the Vinton Oil and Gas Company; S. H. Watson, H. H. Eddy, A. B. Dowell and others.

PITTSBURG, PA.—The Chartiers Valley National Gas Company will greatly increase the plant. Stock to the amount of $1,000,000 will be issued to pay for it.

NEW YORK.—Bids were opened on Monday, May 16, for lighting the streets with electric-lights for the coming year. The following were the bidders: United States Illuminating Company, $182.50 per year, or 50 cents per night; The Brush Electric Light Co., $91.50 per year, or 25 cents per night; Ball Electric-Light Co., 25 cents per night; East River Electric-Light Co., portion of the city, $160 per year: another portion, $181.50 per year; Harlem Lighting Co., arc-lights, 42½ cents per night, $155.55 per year. For lighting Third Avenue Bridge, the Harlem Lighting Co. bid 74 cents per night or $255.50 per year, and for four lights in the tower at Mount Morris Park they bid 70 cents per night. They also offered to place 50 incandescent lights in Mount Morris Park at five cents each. The North New York Lighting Co. bid $146.40 per year. The Gas Commissioners will meet on Monday afternoon, May 23, to take action on the bids.

JAMESTOWN, N. Y.—Town meeting, May 14, voted to ask the State Legislature for authority to bond the town for $500,000 to develop natural-gas for manufactures.

FREDONIA, N. Y.—Active operations are going on for the development of natural-gas wells. Address M. M. Fenner of this place.

BROCKTON, MASS., has made a contract, to run ten years, with the Edison Electric-Light Company to light certain streets.

GAS COMPANY.—The Welsbach Incandescent Gas-Light Company, the directors of which are mostly Philadelphia capitalists, has been incorporated in New York City, with a capital of $4,500,000. The directors include John Wanamaker, Thomas Dolan, and George Phillen, of Philadelphia. The light is the invention of Professor Auer von Welsbach, of Austria.

KNOXVILLE, TENN.—The Knoxville Woolen Mills Co. has contracted for 300 Edison incandescent electric-lights of 16-candle power.

PHILADELPHIA, PA.—The Department of Public Works will advertise for proposals for the construction of an addition to the purifying house of the Ninth Ward Gas-Works. This will cost about $30,000.

OGDEN, UTAH, will have gas-works, to cost $6,500.

JAMESTOWN, N. Y.—Permission has been given to the Jamestown Electric-Light Company to erect poles and wires, and place lamps of 1,200 candle-power for street-lighting.

INCORPORATED are the Germania Oil and Gas Company, of Cadiz, O., and the Guarantee Gas Company, of Willisville, O.

NEWBURG, N. Y., has made a contract with the Newburg Electric-Light Company to furnish 75 arc lights of 1,200 candle-power each, at $10,000 annually.

CUMMINSVILLE, O.—The Northside Natural-Gas and Oil Company has been organized, with Herman Haerlein, Dr. William Judkin, and others as directors. Wells will be sunk.

WOBURN, MASS., has contracted with the Woburn Electric-Light Company for 40 arc-lamps at $2,500 annually.

HYDE PARK, MASS., Selectmen will contract with some electric-light company for lighting the streets. The cost is limited to $4,000 annually.

RAILROADS, BRIDGES, CANALS.

A RAILROAD is projected from Atlantic City, N. J., to Brigantine Beach.

WOONSOCKET, R. I.—About six miles of street railroad will be built here and electric motors will be used in the running of the cars.

FULTONVILLE, N. Y.—A new iron draw-bridge will be built over the Erie Canal here.

INCORPORATED is the Erie, Butler and Pittsburg Railroad with a capital of $1,500,000. It will extend from Erie to Mercer, Pa.

BRIDGE.—A bill is before the New York State Legislature extending the time within which the New York and Canada Bridge Company must build a bridge over the St. Lawrence at Waddington, N. Y.

ATCHISON, KAN.—The Wrought-Iron Bridge Company, of Canton, O., has the contract for a viaduct over the railroad track here at $13,600. It will be 400 feet long.

BRIDGE.—The Union Bridge Company have a contract for a $3,000,000 bridge over the Ohio River at Cairo.

TUCSON, ARIZ.—Town officials here can give information about a new broad-gauge railroad.

WINONA, MINN.—The citizens of this city will give $200,000 and other communities $150,000 toward the construction of the Winona and South-western Railroad.

DALLAS and Oak Cliff, Tex., Elevated Railroad has been incorporated to build an elevated road; T. L. Marsalis, Thomas Field, and others.

RAILROAD.—The Fort Dodge and Sioux Falls Railroad Company will build from Des Moines to Sioux Falls.

RAILROAD.—The stockholders of the Cleveland & Canton Railroad have voted to place a $2,000,000 mortgage on the road to change the narrow gauge to standard. The work will begin at once.

BRIDGE.—The towns of Minden and Palatine, Montgomery County, N. Y., have accepted the bid of the Phœnix Bridge Company, of New York, for the construction of a bridge across the Mohawk, from Fort Plain to Nellistown, for $34,500. The bridge will be of wrought iron, with a single span of 325 feet and a total width of 20 feet, including two walks and a driveway. The frame-work will be 50 feet high from the road-bed.

SIOUX CITY, IOWA.—The North-western and St. Paul and Omaha railroads have contracted to build a million-dollar bridge, under the name of the Sioux City Bridge Company.

FLUSHING, LONG ISLAND.—The village trustees will, on the evening of June 2, consider an application from an electric railroad company, to operate an electric railroad through the principal streets of the village. Three different companies, two of which are horse railroad companies, have made application for a franchise.

CINCINNATI, O.—A project is being discussed here, looking to the building of twelve miles of elevated railroad.

INCORPORATED is the Winona, Iowa, and South-western Improvement Company, of Winona, Minn. The Winona and Southern Railroad will be built.

NEW YORK CITY.—The Rapid Transit Commission will receive plans for the routes already announced. On June 7 the plans will be decided upon.

RAILROAD.—The Mexican National Railroad has been sold to a new syndicate, which will complete it.

STREET RAILROAD.—The franchise for the Fulton Street Railroad in New York City will be sold by the Commissioners May 31.

NORRISTOWN, PA.—The Citizens' Passenger Railroad Company has let a contract for about 13 miles of road.

MINNESOTA and North-western Railroad has just let contracts for $75,000 for grading and additional buildings in St. Paul, Minn.

SIOUX CITY, IA.—The Chicago and North-western, and the St. Paul, Minneapolis and Omaha Railroads have accepted the plans of the local bridge company, and a $300,000 structure will soon be begun. General Superintendent Whiteman, of the St. Paul and Omaha Railroad, can give further information.

RAILROAD.—A certificate of the incorporation of the Flushing and College Point Electric Street Railway Company was filed at Albany, May 9. Capital stock, $150,000, and incorporators are as follows: Hugh R. Garden, Harry C. Davis, Edwin J. Houston, H. D. Garden, Herbert N. Curtis, C. H. Barney, John M. Robertson, A. D. Schlesinger, S. M. Pryor, John Rooney, George C. Lee, John E. Coggeshall, and F. S. Holmes.

MISSOURI, KANSAS AND NEBRASKA RAILROAD has just begun its surveys under John M. Walker, of Lawrence, Kan.

INCORPORATED is the Lawrence, Emporia and South-western Railroad of Kansas. Projected is the Kansas City, Lawrence and Nebraska Railroad.

RAILWAY.—Surveys for the Augusta and Chattanooga Railroad are finished and contracts let.

FINDLAY, O.—The City Council have granted a franchise for an electric street railroad to S. T. Dunham, of New York.

WALLA WALLA, WASH. T.—An effort is being made to have a railroad built between Tacoma and Walla Walla. The directors of the Walla Walla and Puget Sound Railroad Company held a meeting recently, and appointed a committee to secure a subsidy of $75,000 to build the road at once. Levy Ankeny may be addressed.

MINNEAPOLIS.—The Council Committeee on Railroads is informed by City Engineer Rinker that about forty bridges must be built over various lines of railroad tracks, costing from $8,000 to $10,000.

BIDS OPENED.

BROOKLYN, N. Y.—Bids for sewers opened, May 10, by the Department of City Works: John S. Bogert, 30-inch brick sewer, per running foot, $3.75; 12-inch cement pipe, per running foot, $1.25; 15-inch cement pipe, per running foot, $1.55; manholes, each, $36; street basins, each, $110. Harris & Maguire, 30-inch brick sewer, per running foot, $3.48; 12-inch cement pipe, per running foot, $1.08; 15-inch cement pipe, per running foot, $1.45; manholes, each, $35; street basins, each, $100. John Bray, 30-inch brick sewer, per running foot, $3.15; 12-inch cement pipe, per running foot, $1.03; 15-inch cement pipe, per running foot, $1.34; manholes, each, $33.50; street basins, each, $98.

CLEVELAND, O.—The Board of Education has received bids for constructing the buildings on Petrie and Consul Streets. The lowest bidders for the Consul Street building are Julius Schulze, mason-work, $11,200; Joseph Young, cut-stone, $4,645; Skeels Bros., carpenter-work, $8,320; Alex. Forrester, lath and plaster work, $1,414; Rudolph & Lewis, galvanized iron and tin work, $664.50; Macbeth & Co., iron-work, $3,385; Hermann Niemann, painting, $865; Auld & Conger, slating, $1,159; Isaac D. Smead & Co., heating and ventilating, $3,990; total, $55,642.50.

The lowest bidders for the Petrie Street building are; W. T. Latimer, carpenter-work, $8,355; Buhrer & Schledt, cut-stone, $4,958; Julius Schulze, mason-work, $11,200; Thomas Tarbett, lath and plaster work, $1,400; Rudolph & Lewis, galvanized iron and tin work, $3,385; C. C. Gibson, painting, $575; Auld & Conger, slating, $1,159; Isaac D. Smead & Co., heating and ventilating, $3,990; total, $35,871.50.

LYNN, MASS.—The contract for the granite-work of the French Catholic Church has been awarded to Blethen & Curry, of this place.

ALLEGHENY, PA., has let a contract for cleaning 16,000 lineal feet of water-mains and removing incrustations to Kerr & Lawrence, of Minersville, at 15 cents per lineal foot for 6-inch pipe; 20 cents for 8-inch; 25 cents for 10-inch, and 30 cents for 12-inch.

PHILADELPHIA.—Bids for the construction of a 60 feet wide three-arch stone bridge over the Wissahickon Creek, were opened at the Survey Bureau and the following received:

H. P. McTayne, $33,258 for the bridges with stone arches and $32,056 with brick arches.

James Sullivan, $43,000, with stone, $41,000 with brick arches.

P. McManus, $39,900 with stone and $37,800 with brick arches.

W. H. Hachieff, $41,000 and $39,900.

James Dechan, $32,800 and $32,300.

J. H. Hathaway, bid $39,000 for the brick arch bridge.

The only bidder for a wooden bridge over the Philadelphia & Reading R. R. was J. H. Hathaway, at $1,400.

SALEM, MASS.—On May 16 the Essex County Commissioners opened bids for the Court-House extension as follows: O. L. Geddings, Exeter, N. H., $114,000; James E. Manning, Lynn, $159,997; Parsons and & Petersen, Salem, $166,950; J. J. & T. F. Mack, Salem, $169,316; Dearbon, Ross & Co., Lynn, $180,400; Albert Currier, Newburyport, $183,767; L. D. Wilcott, Boston, $210,509; N. T. Davidson, Lynn, $211,275. The contract has not yet been awarded.

CORNING, N. Y.—The following bids for sewers and appurtenances were received on May 17. Carroll P. Bassett, of Newark, N. J., engineer in charge of the work.

Bidders.	William H. Bray, Mine Hill, N. J.	Stanton & Dayle, Cohoes, N. Y.	Jones & Ellsworth, Rochester, N. Y.	John McDougall, Son & Co., Hornellsville, N. Y.	James & R. H. Walker, Elmira, N. Y.	T. Newman, F. A. Snow, Providence, R. I.	Doremus & Staats, 171 Broadway, N. Y.	Kingston Drew, 221 Main Street, Buffalo, N. Y.	Brown & Buckley, Mohawk, N. Y.	Clark & Byron, 379 W. 125th Street, New York	Wm. E. Dean, W. End Stables, 139 W. 125th St, N. Y.	John Cannon & P. Marray, Elmira	Griffith & Gorton, Corning, N. Y.	Geo. B. Allen & D. W. McConnell, Buffalo
Price per half basin, complete.	$50.00	8.00	20.00	12.00*	10.64	16.00	9.00‡	13.00	24.00	25.00	15.00	12.00†	15.25	25.00
Price per pound for iron-work in place.	.5	.4	.5	.2*	.7	.3†	.2‡	.3	.3†	.5	.3	.3	.2	.3
Price per flush-tank, complete.	$37.50	40.00	75.00	28.00	21.50	52.00	36.00	30.00	35.00	60.00	30.00	10.00	34.25	33.00
Price per vertical foot of basin, including all materials and labor.	$7.50	4.50	7.00	5.50	6.00	6.70	6.20	4.35	8.00	15.00	7.50	3.00	0.77	3.50
Price per vertical foot of ordinary manhole, including all materials and labor.	$6.25	4.00	4.00	4.50	3.17	5.10	4.00	4.40	4.06	2.35	3.00	3.00	4.33	3.70
Price per vertical foot of special manhole, including all materials and labor.	$7.50	4.50	5.00	5.00	3.17	5.20	4.33	5.00	5.07	2.50	4.50	4.00	3.50	3.90
Price for 6-inch sewers as located.	$.65	.45	.40	.28‡	.34	.85	.34	.38	.54	.60	.37	.32	.39	.44
Price for 8-inch sewers as located.	$0.72	.55	.65	.37½	.43	1.05	.44	.47	.62	.75	.43	.44½	.48	.49
Price for 9-inch sewers as located.	$0.84	.82	.70	.42¼	.52	1.15	.57	.56	.67	.85	.47	.51¼	.50	.49½
Price for 10-inch sewers as located.	$0.91	.84	.80	.50¼	.58	1.15	.69	.61	.71	.90	.51	.60½	.60	.54½
Price for 12-inch sewer in Mill Street.	$1.11	1.07	.85	.61¼	.73	1.75	.77	.83	.82	1.19	.57	.68	.73	.70
Price for 18-inch outfall sewer through Second Street.	$1.83	1.86	1.40	1.09‡	1.26	1.90	1.26	1.29	1.27	1.71	1.23	1.13	1.10	1.20
Price for 9-inch storm-water sewers as located.	$0.94	.59	.70	.39½	.52	.86	.45	.53	.68	.86	.45	.51¼	.48	.49½
Price for 10-inch storm-water sewers as located.	$.91	.64	.75	.45½	.58	1.00	.51	.58	.71	.90	.53	.60½	.58	.54½
Price for 12-inch storm-water sewers as located.	$1.11	.74	.80	.55½	.73	1.13	.60	.69	.32	1.19	.60	.68	.68	.64
Price for 15-inch storm-water sewer in First Street.	$1.35	.98	1.08	.76¼	.95	1.18	.85	.97	1.03	1.43	1.30	.86	.83	.96
Price for 18-inch storm-water sewer in First Street.	$1.83	1.22	1.30	1.09⅝	1.26	1.50	1.15	1.20	1.27	1.71	1.50	1.13	1.10	1.15½
Price for 24-inch storm-water sewer in Frst Street.	$2.75	2.08	2.15	1.70½	2.05	2.55	1.75	2.10	2.08	2.85	2.30	1.95	1.33	1.79
Price per lineal foot for excavating trench, furnishing materials, constructing, back-filling, etc., outfall storm-water sewer 30"x46".	$5.50	5.48	4.75	4.38	6.29	6.75	4.68	4.85	6.15	5.00	5.50	6.00	3.25	4.40

* Lowest bidder; † 2d lowest; ‡ 3d lowest.

PHILADELPHIA.—Bids were received at the Gas Bureau of the Department of Public Works, May 9, for supplies for the ensuing year, and among the items were the following: Class I. represented wrought-iron tubing, and he bidders were: The Reading Iron Works of Philadelphia, Ford & Kendig, and Hunter & Dickson, their respective bids being as follows:

1,000 feet wrought-iron tubing, ¼-inch, 2.4, 2.4, 2¼ cents.

1,000 feet wrought-iron tubing, ⅜-inch, 2.4, 2.4, 2⅜ cents.

100,000-feet wrought-iron tubing, 1½-inch, 1½ pounds to foot, 4.3, 4.2, 3.9 cents.

20,000 feet wrought-iron tubing, 1 inch, 1.67 pounds per foot, 5.8, 5.7, 5½ cents.

5,000 feet wrought-iron tubing, 1¼ inch, 2.25 pounds per foot, 7.7, 7½, 7⅛ cents per foot.

5,000 feet wrought-iron tubing, 1½-inch, 2.69 pounds per foot, 9.9, 9.9, 9.9 cents per foot.

3,500 feet 2-inch, 3.66 pounds per foot, 12.6, 12.6, 12.2 cents.

For cast-iron pipe the bidders were: Gloucester Iron-Works, of Philadelphia, and the McNeal Pipe and Foundry Co., of Burlington, N. J. Among the items were: 6,000 feet 4-inch pipe, 16 pounds to foot, the bids being 1.75c. and 1.74c. per pound.

2,000 lengths 3-inch pipe, 11 pounds to foot, 1.95 and 1.94 cents per pound.

1,000 lengths 12-inch pipe, 69 pounds to foot, 2.63 and 3 cents per pound.

For 500 lamp-posts complete, not weighing less than 250 pounds, the bidders were: Whittaker & Co., $6.75, and Samuel J. Cresswell, $6, each.

For lead pipe, Tatham & Bro., of Philadelphia, bid 5.6 cents per pound, for 21,100 pounds of pipe, ranging from ⅝-inch, weighing 1½ pounds per foot, to 3 inches, weighing 12 pounds per foot. They were the only bidders.

The bids for meters for the department were as follows:

Number of meters.	Power.	Helms & McIlhenny, Philadelphia.	American Meter Co., Philadelphia.	Goodwin Gas-Stove and Meter Co., Philadelphia.	Harris, Griffin & Co., Philadelphia.
3,000	3-light	$4.10	$5.05	$4.40	$5.00
2,600	5 "	5.20	0.35	5.40	5.40
1,000	10 "	6.50	8.10	6.60	8.00
300	20 "	9.00	11.00	9.70	9.40
125	30 "	12 25	15.15	13.40	13.00
75	45 "	18.00	22.20	18.80	22.00
45	60 "	24.50	30.25	26.75	25.00
48	100 "	39.50	50.50	42.00	42.00
12	150 "	63.00	76.75	68.50	70.00
6	200 "	88.00	106.50	95.60	90.00
6	300 "	150.00	189.00	163.70	155.00
3	500 "	250.00	300.00	300.00	300.00

They are all dry meters.

ST. PAUL.—The Board of Public Works has awarded contracts as follows: grading Maryland Street, from Lake Como to Bock Street, to Palmer and Dunkler for $64,120; Cypress Street, from Suburban Avenue to Seventh, to V. B. Parks for $12,471. The board has reported favorably on the following: opening and extending Summit Avenue south, to the intersection of Otto Avenue and Summit Avenue, at an estimated cost of $18,000; grading State Street, from South Robert to Isabel, and South Robert, from State Street to south city limits, at an estimated cost of $18,370, per lineal foot $2.30; grading Frances Street, from Arcade to Hope, at an estimated cost of $1,654.50, per lineal foot $1.80; paving College Avenue, from Cedar to West Third Street, $19,923, per lineal foot $4.63.

GOVERNMENT WORK.

CINCINNATI, O.—At the opening of bids, May 11, for furnishing stone for constructing a lock on the Little Kanawha River, by Major James C. Post, U. S. Engineers, but one was presented—from J. V. Hoag, of Pittsburg, Pa., at $7 per cubic yard for dimension stone and $5.50 per cubic yard for backing stone. The estimated quantity was 1,090 cubic yards all together. As there was but one bid there may be no award.

OXFORD, MISS.—Synopsis of bids for approaches of the Court House and Post-Office opened May 10, by the Supervising Architect of the Treasury:

McCarthy and Corbett, Washington, D. C., 1st division, sidewalks, brick, $1,100; 2d division, sidewalks, macadam, $900; 3d division, masonry, $4,100; total, $6,100, or if all divisions of work as accorded, $5,000.

Dumesneil Bros., Louisville, Ky., $1,400, $1,250, $5,650, $8,300, or $6,200.

QUINCY, ILL.—The following bids for machinery for a hydraulic dredge were received by Captain E. H. Ruffner, U. S. Engineers, May 14:

Joseph Edwards & Co., centrifugal pump, $1,720.55; discharge-pipe, $2,274; total, $3,494.55.

Lindon W. Bates, Kansas City, Mo., $3,450; no bid on discharge-pipe; total, $3,450.

Goulds & Austin, Chicago, Ill., $1,322; $2,225; total, $3,547.

John Specht, Dubuque, Iowa, $600, for a second-hand pump.

The Laurence Machine Co., Boston, Mass., $1,850.50; $2,158; total, $4,008.50.

L. M. Ramsey Manufacturing Co., St. Louis, Mo., $600; $2,867.50; pump only; total, $3,467.50.

No action has yet been taken.

HASTINGS, MINN.—S. J. Truax has secured a $25,000 contract of Government work at Guttenberg, Glen Haven, and Cassville, near Dubuque, Ia.

ABSTRACT of bids received by the Engineer of the Third Light-house District on the 18th of May, 1887, for material for eleven fourth-order light-house lanterns: The H. A. Ramsay Marine Engine Co., Baltimore, Md., $4,821; The Colwell Iron-Works, New York, $3,500.

SYNOPSIS of bids opened May 14, 1887, by Supervising Architect for iron-work of silver storage vault, North Court, Treasury Building, at Washington, D. C.: Manly & Cooper Manufacturing Co., Philadelphia, Pa., $13,250 (only bid). Bid rejected and circular letter of May 18, 1887 sent out asking for new bids.

NEW YORK CITY.—The *Tribune's* Washington correspondent reports that the Government will begin work on the canal connecting the Harlem and Hudson Rivers in a few weeks.

NEW YORK.—Bids were opened by Lieutenant-Colonel Walter McFarland, at the Army Building, at noon, on Wednesday, May 18, for improving New York Harbor, Main Ship Channel, in the vicinity of Flynn's Knoll, or from the Swash Channel, by dredging. The approximate quantity to be removed, upon which the bids were calculated, was 1,000,000 cubic yards. The following were the bidders:

Joseph Edwards Dredging Company, New York 28½ cents per cubic yard; total, $285,000. Joseph Cummings, New York, 37½ cents per cubic yard; total, $375,000.

MISCELLANEOUS.

TOO LATE FOR CLASSIFICATION.

ST. PAUL.—The Board of Education has accepted plans of Willcox & Johnston, architects, for addition to the high school to cost $25,000. Contract was awarded Ruttan Manufacturing Co., for two Ruttan furnaces with ventilating apparatus in each; 4-room school building at $1,100, including flue-heaters for Smead's dry-closet system. M. D. Rundle was awarded the contract for the additions to the Van Buren school at $27,650.

BISMARCK, DAK.—A contract with New York capitalists for putting in a reservoir system of water-works at Bismarck was closed in Chicago. Work is to be finished November 1. The water is obtained from the Missouri River, and the reservoirs are located just above the Northern Pacific bridge and 150 feet above the city. Cost, about $100,000.

ST. CLOUD, MINN.—The City Council is soon to consider a proposition from H. D. Upton, representing Eastern parties, to purchase water-works and improve them. The proposition is, to put in four miles more of mains, to give city 50 hydrants for $3,570 or 100 for $4,500 and pay the cost of present works, about $23,000.

ST. PAUL.—The Commission, to locate the new reform school, decided at its session in this city last week on Red Wing. A farm of 600 acres has been purchased for $20,000. The buildings to be erected are sixteen in number, costing about $200,000.

PORT JERVIS.—The Sewer Commission has reported in favor of the small pipe system of sewers for the village. Drain-pipe will be wanted.

PATERSON, N. J.—The city authorities want proposals for electric-lighting. Bids will be received until May 25 at 5 o'clock. The available amount is $32,500.

SIOUX CITY, IA.—A union railroad bridge is to be built across the Missouri River here. The structure will cost a million and a half.

MADISON, WIS.—A 1,200-foot tunnel is to be built near Dayton, Greene County, on the line of the Chicago, Madison and Northern Railroad.

WILKESBARRE, PA.—Warren Flick, C. E., is designing a system of sewerage for Ashley, Pa.

CITY OF MEXICO.—M. Cerdau, a Frenchman, has received the contract for improvements in the harbor of Vera Cruz. The Government pays $4,000,000 for the work.

GREENVILLE, MISS.—The Levee Board receives estimates from its engineer for $400,000 of new work.

The Sanitary Engineer and Construction Record.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 15. NUMBER 26. PUBLISHED EVERY SATURDAY.

NEW YORK, MAY 28, 1887.
LONDON, JUNE 11, 1887.

SINGLE COPIES, TEN CENTS. Subscription, $4.00 per year in advance, post paid. IN AMERICA
SINGLE COPIES, SIXPENCE. Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, *conducted by* HENRY C. MEYER, *is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.*

TERMS, $4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. *Postage Paid.*
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed —— ——& Co.

Continental subscriptions are also received by F. A BROCKHAUS, Esq., Querstrasse 29, Leipzic, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, $5; China, Japan, Sandwich Islands, Mexico and Cuba, $5; South America, $5.

The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

Subscribers will please notify us *promptly* of any failure to receive the paper, and also of any change in their address.

Remittances are at the risk of the sender, unless made by registered letter or by check or money order payable to THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

When a change of address is desired, both the old and new addresses should be given.

TABLE OF CONTENTS.

INVALIDATING A SEWER ASSESSMENT.

IN October, 1885, the Common Council of the city of Utica passed an ordinance providing for the construction of a sewer according to plans and specifications on file with the City Clerk. The cost of same was to be assessed upon adjoining property-owners, in the manner provided by the city charter. The plans and specifications called for a sewer nine feet below the surface of the street, public notice was given of its proposed construction, and the contract was let accordingly.

After the work had been commenced, it was discovered that this sewer would be too low to admit of proper connection with the sewer in an intersecting street as was contemplated by the city ordinance. Under the direction of the City Surveyor, in order to obviate this difficulty, the contractor constructed the sewer only about six feet below the surface of the street.

Subsequently an assessment was laid upon adjoining property in order to meet the expense of this sewer. An adjoining property-owner thereupon instituted proceedings in the Supreme Court to set aside the assessment on the ground that the ordinance of the Common Council provided for the construction of a sewer nine feet below the street-level, public notice was of such proposed sewer, and the contract was let upon that basis; whereas the sewer actually constructed was only about six feet below the street-level.

The Court held that the difference in depth was a material deviation from the contract and from the ordinance authorizing the contract, and that therefore no valid assessment could be imposed upon the adjoining property-owners to meet the cost of the work.

This leaves open the question, whether the city is bound by the action of its City Surveyor. If, however, the Common Council should ratify his act, and award payment to the contractor, still the cost must then be borne by the entire city, instead of by the adjoining property-owners alone, which would have been the case had the original plans and specifications provided for the sewer which was actually constructed.

REGARDING GAS-PRESSURE IN NEW YORK.

THE New York *Herald* recently devoted a column and a half to an attempt to prove that as the price of gas was reduced the consumers' bills increased. This condition of things was accounted for on the supposition that the moment the price was reduced the gas companies put a "powerful pressure" on their mains in order to force more gas through the consumers' meters. Of course the *Herald* does not present any proof to show that the companies actually *have* increased their pressure, but contents itself with presenting the gas-bills of certain stores and hotels. Now these bills simply show that during a certain period when the price of gas was $1.25 per 1,000, the meter registered a larger consumption of gas than during the corresponding period when the price was $1.75, and that in consequence the bill was larger. On the bare statement of the proprietor that "no more light was used" during one period than the other, the conclusion is immediately jumped at that the pressure must necessarily have been increased to account for the increased consumption. To no fair-minded person would this style of reasoning commend itself. So long as an increase of pressure by the companies is a matter susceptible of easy proof, the unbiased reader very naturally asks that such proof be produced before accepting the statement. Newspaper articles of this nature are quite frequent now, and sound more like an attempt to create a sensation or bolster up the waning fortunes of some patent gas-governor than an honest effort to establish a fact.

If the gas companies have increased their pressure for any such purpose as that claimed by the *Herald*, we should be very glad to learn of the fact, and should be most unsparing in condemnation of it. At the same time we want some proof that such is the case other than the fact that the gas-bills of some hotels are larger than they were two or three years ago.

As to the *Herald's* article, it is rather strange that the names of these hotels and stores are not given. Four examples are cited to support the "increased pressure" story, but in no case is the name of the establishment mentioned, except to say that it is "one of the largest hotels on Broadway, above Twenty-third Street," "a large dry-goods house on Eighth Avenue," etc.

It would be a matter of interest to know how many places of business were visited during the *Herald's* search for "facts," in which the decrease in the price of gas had resulted in *lower* bills.

The consumers who appear to profit by the lower price are not heard from.

Undoubtedly the *Herald* will admit that if the companies have increased the pressure in order to force gas through the meters, this increase of pressure has come to all alike who happen to be supplied through a common channel. All alike, then, should complain of the increased pressure, except, possibly, in a few cases where the consumer has applied some simple check. Did the *Herald* find this to be the case?

The proprietor who states that "no more light was used" in one month than another admits that there has been no increase in his business, and even if such is the case it is impossible, from the very nature of gas consumption in a hotel, for the proprietor to tell when his guests are using more gas and when less, except by the registration of the meter.

For ourselves, we fail to see where an unnecessary increase of pressure would benefit the companies, knowing as they do that it would greatly increase the leakage of gas from their mains, a leakage which is already not far from 15 per cent. of the total quantity of gas made, and knowing also that the consumer could, with a little precaution, defeat the scheme.

Moreover, the pressure records of the Gas-Examiner's office show that the pressure is practically the same as it was before the reduction in price, as will be seen by the following table of average pressures during lighting hours for the years 1883–1886:

COMPANY.		1883 in.	1884 in.	1885 in	1886 in.
New York.	Average maximum	1.63	1.48	1.45	1.46
	" minimum	1.44	1.28	1.28	1.25
Manhattan.	Average maximum	2.64	2.25	2.27	2.22
	" minimum	1.30	1.22	1.28	1.25
Mutual.	Average maximum	2.89	2.72	2.56	2.64
	" minimum	1.88	1.99	2.03	1.78
Municipal.	Average maximum	2.43	2.09	2.34	2.35
	" minimum	1.13	1.21	1.39	1.36
Metropolitan.	Average maximum	1.55	1.54	1.50	1.45
	" minimum	0.88	0.98	0.87	0.79

The only class of persons likely to be benefited by newspaper articles such as that of the *Herald* are those having patent governors or governor-burners to sell. By leading the public to believe that it is being dreadfully swindled by the excessive pressure put on the gas-mains, such interested persons are enabled to proclaim the wonderful advantages of this or that device to "keep down gas bills."

Whether the writers of these articles get their inspiration from such source or not we cannot say; but the practice of arousing public indignation over a state of things which has not been proved to exist is, to say the least, not very commendable.

UNDERGROUND WATER.

THE paper by Professor W. P. Trowbridge, which we reproduce on another page, from the *School of Mines Quarterly*, is an interesting record of some experiences in boring for ground-water supplies which have come under the writer's observation. The illustrations of the appliances used in making test borings in soils which are free from rock will be valuable to engineers who have not experience in this simple and effective method of discovering the underground formation of territory explored for purposes of construction of works.

The experiment cited of the test on Long Island, where continuous pumping from a number of tube-wells in an area of 12,000 square feet lowered the water-level four and two-thirds feet and affected the surface over an area a mile and a half in diameter, accords with experience in other localities, and should be taken account of in all calculations when water from underground sources is under consideration for a public water-supply. In many cases the driven well is cheaper to construct than an open well or gallery would be, but it cannot yield more water, nor be more certain of producing an unfailing supply.

OUR BRITISH CORRESPONDENCE.

The Education of an Architect Discussed at Conference of Architects—Papers at Iron and Steel Institute.

LONDON, May 11, 1887.

APROPOS of the discussion that has been going on in the columns of THE SANITARY ENGINEER AND CONSTRUCTION RECORD respecting the preliminary education for an architectural profession, the papers read at the eighth general meeting of the Architect's Association in London are of interest. One paper was read by Professor Babcock, of Cornell University. The Professor held that architecture was a fine art based upon a mechanical art, and that although the architect need not be a mason or a carpenter, he must know how to design good masonry and carpentry and be competent to express judgment upon such departments. The proper subjects for study he gave as Building, Mathematics, General Sciences, History of Style, Drawing, Designing, and Language. Under the head of General Sciences he embraced physics, chemistry, botany, geology, and mineralogy. Mr. Sedding read a paper on the relations of architecture and handicraft. Mr. Robins read a paper on the technical education of students of architecture. Mr. Robins quoted the following as the syllabus for the first year's course: Mathematics—geometry, plane and solid, descriptive and analytical, conic sections, trigonometry, mensuration, and algebra; Art—the history of the architecture of all ages and countries, freehand and linear drawing, projection and tinting, mechanical drawing, and the elements of perspective; Physics—experimental mechanics, heat, optics, electricity, acoustics, laboratory practice; Chemistry—the chemistry of physics, materials, elementary chemistry, and laboratory practice; Hygiene; Language—either French or German, or both. Mr. Arthur Hill, of Cork, contributed a paper on "College Training for Architects." Mr. Lawrence Booth, Mr. Aitchison, and Mr. Gotch contributed papers on the same subject. The last-named commenced his paper by saying that learning to be an architect was about as arduous a task as any man could undertake. Referring to the custom of simply articling the young man as the first step in the progress of his profession, he asked what an apprenticeship did for the young man, and maintained that in nine cases out of ten, the best result was that he would turn out an *architectural practitioner*, but very few offices would turn him out an *architect* with a desire to tread the higher and nobler paths of his profession. In the course of the discussion on one paper, Mr. John Brett aptly illustrated the narrow scope given the architect in England as opposed to that in America. He stated that before coming to the discussion, he had gone into one of the clubs and asked the librarian to give him any book illustrating the Italian Domestic Architecture, telling him at the same time that he wanted to know something about internal construction. The librarian thereupon informed him that the word architecture applied to the *outside* of the building and not to the inside. This will probably astonish American architects, whose duties are not terminated when they have designed the shell of the house, as is so frequently the case in England.

The Iron and Steel Institute meeting will be held on the 26th, 27th, and 28th inst. Papers are announced by Mr. Percy Gilchrist, on "Basic Slag as a Manure;" Sir Bernhard Samuelson, on the "Terni Steel Works;" Mr. Riley, of the Steel Company of Scotland, on "Steel Plates;" Mr. Turner, of the Mason Science College, on the "Production of Silica from Cast Iron;" Mr. George Allen, of the Congreave Iron-Works, on "Patent Composite Iron and Steel," and Dr. Sosby, of Sheffield, on the "Microscopical Structure of Iron and Steel." There will also be a paper read on the "South Chicago Iron and Steel Works.

SAFETY-VALVE.

A RESIDENCE AT GLEN RIDGE, N. J.—WM. CONVERS HAZLETT, ARCHITECT.

OUR SPECIAL ILLUSTRATION.

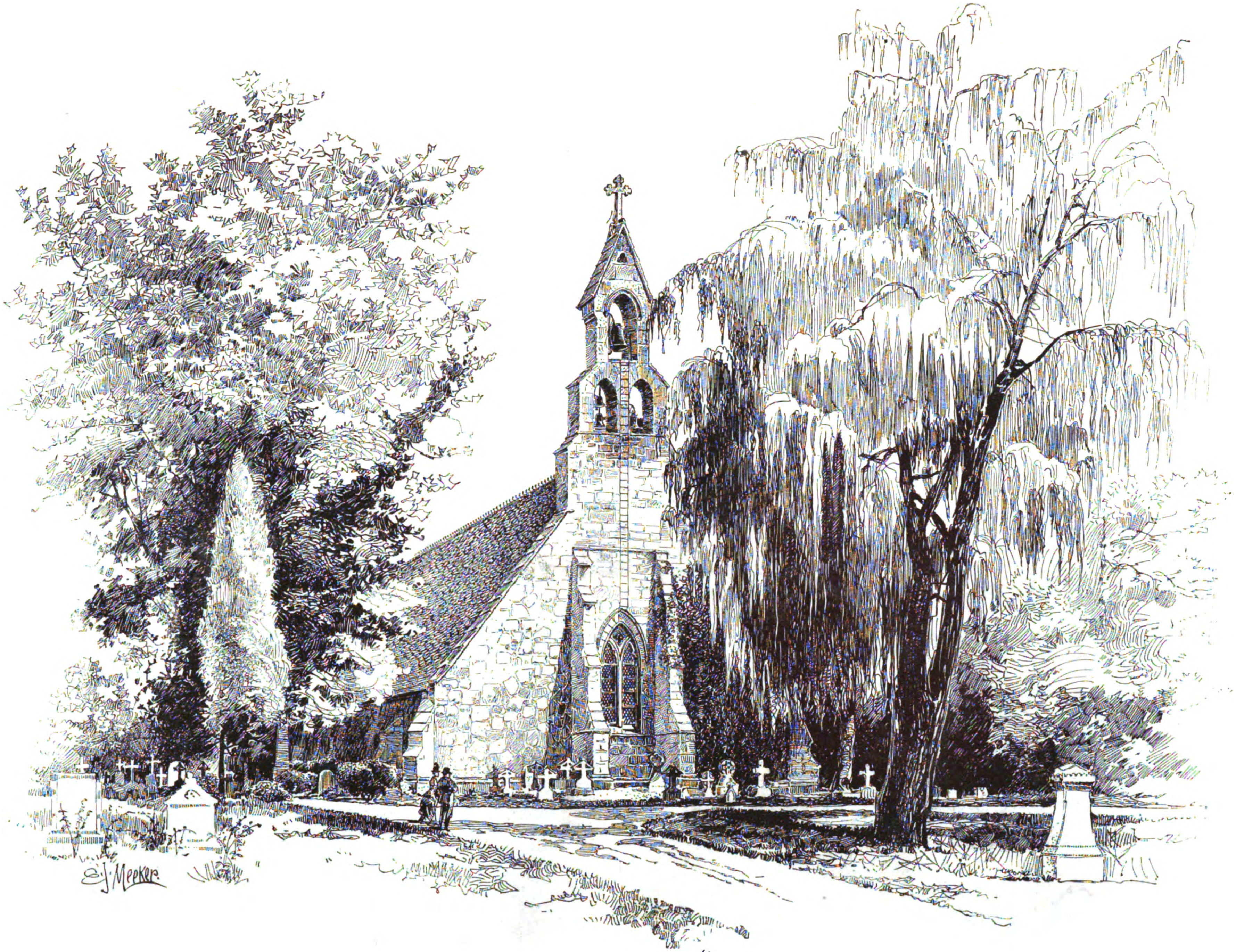
THE subject of our special illustration is the church of St. James the Less, at Falls of the Schuylkill, Pa. It was built in 1846 from plans furnished by the Cambridge Society, of England, and is said to be an exact copy of the Long Stanton Church, Cambridgeshire, England. It was built of the local gray stone.

OUR VIGNETTE ILLUSTRATION.

OUR vignete illustration shows the residence of Mrs. H. C. Cooke, at Glen Ridge, N. J. The building is frame, with stone foundations. The interior finishing of the first floor is of hard wood, and the other floors are of white pine. The cost was $6,500. Mr. W. C. Hazlett, of New York, was the architect.

OUR DETAIL SHEET.

OUR Detail Sheet illustrates some wrought-iron work from designs of T. Roney Williamson and Furness & Evans, architects, and The Manly & Cooper Manufacturing Co., all of Philadelphia.

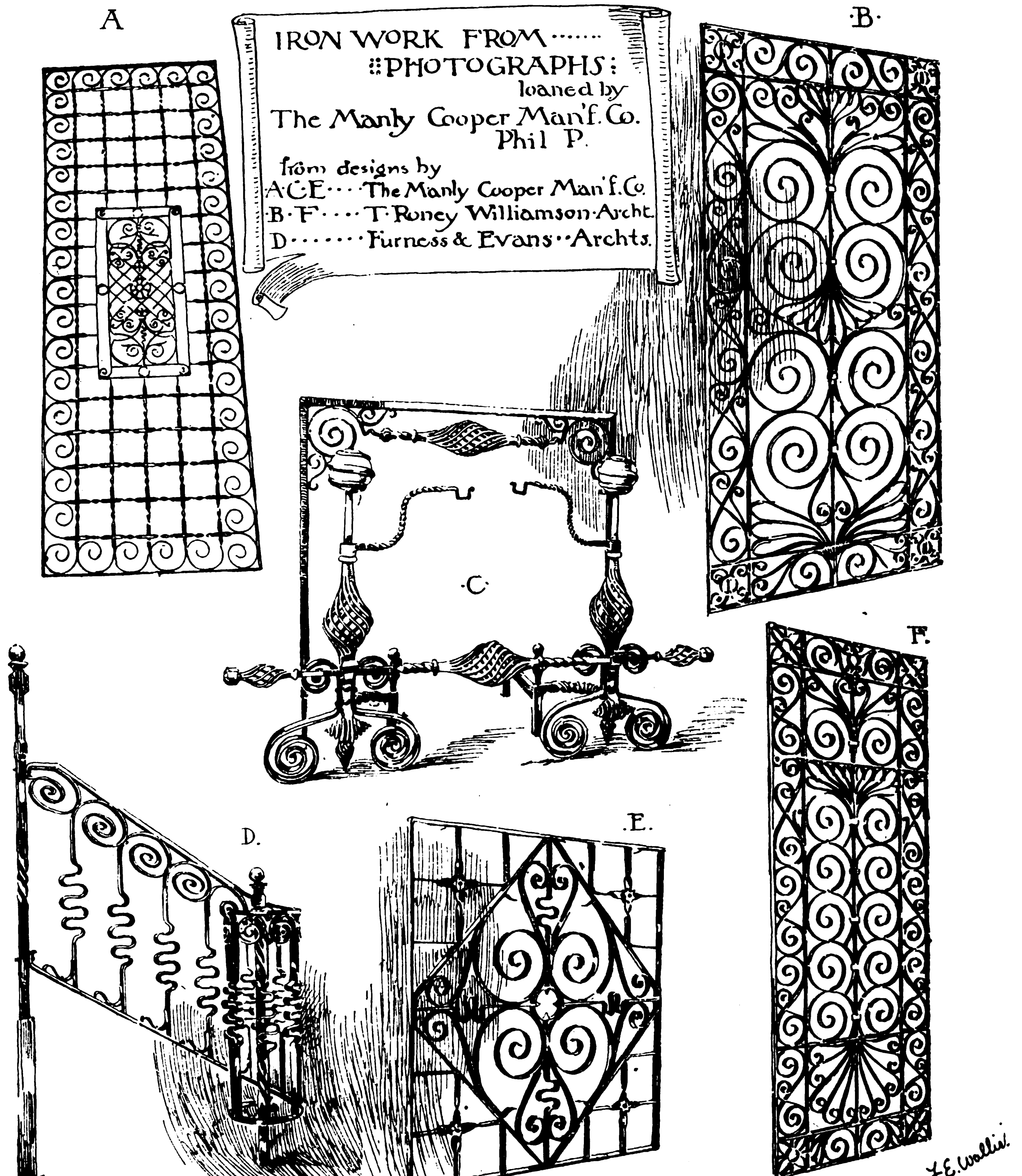


THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

CHURCH OF ST. JAMES THE LESS.

FALLS OF THE SCHUYLKILL, PA.

NEW YORK VOLUME XV.



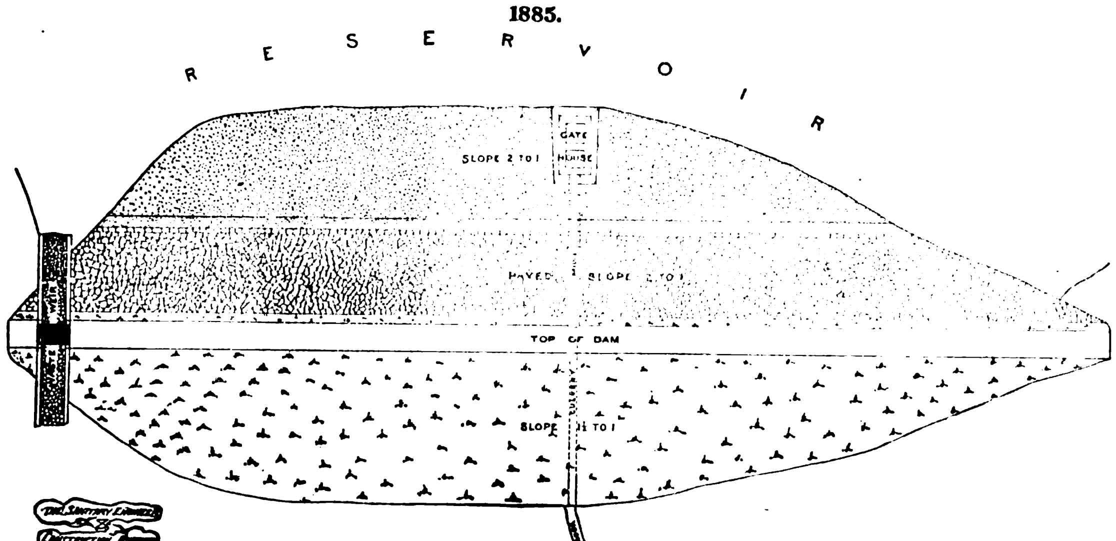
Drawn for The Sanitary Engineer and Construction Record

CHARLOTTESVILLE, VA., WATER-WORKS.

BY an oversight the accompanying illustration of the plan of the dam was omitted from our illustrated description of these works in our last issue.

CHARLOTTESVILLE WATER WORKS.

1885.



PLAN OF DAM.

A COURSE OF INSTRUCTION IN ARCHITECTURE.*

BY PROFESSOR BABCOCK, CORNELL UNIVERSITY, U. S. A.

MAY I not assume, in the presence of the educated gentlemen whom I have the honor to address, that the question of the desirability of educating young men specially for the profession of architecture is one that needs no discussion? May I not take it for granted that a technical education is necessary in order that architects may keep up with the times? They must have a knowledge of art, of science, and of certain mechanical and trade work. How can that knowledge best be acquired? Will the young man get it most readily and thoroughly in an office, through the casual and hurried hints of his employer and the directions given by the chief draughtsman, supplemented by such reading as he can find time for? Or in a proper school, under skilled teachers, whose sole business is to instruct?

I will not waste your time by arguing in favor of technical schools of architecture, and I can say nothing against them. Across the Channel there seems to be no doubt as to their utility; and in the United States, whence I am summoned to address you, there are at least three flourishing schools, parts of large colleges, each with a curriculum extending over four years, and attended, altogether, by about 150 students. Your invitation to read a paper here on the subject of architectural education came to me so recently that I had no time, before preparing it, to learn whether it would be most agreeable to you that I should state the *raison d'être*, or the *modus operandi*, or the practical results of special training in special schools for our particular profession, or consider the possibility of teaching our art at all in such a way as to make it worth while for the student to spend the time and money required for a systematic study of it. I could readily fill up the time allotted to me with my views on any one of these points.

I think, however, that I can most profitably discuss that part of the whole matter which I have had occasion to work out in detail—viz., the subjects of instruction that ought to be included in "A Course of Architecture," and the extent to which each one should be pursued. The courses now prescribed in the American colleges referred to have been printed in your "Journal of Proceedings," so that you have the opportunity of examining their arrangement and details, and of comparing them with one another. I will not take any one of them as a model, but rather state what seem to me the important things to be included in any such curriculum, and the best way of treating them.

The object of a course in architecture should be, if I may quote from the register of the institution in which I am employed, "not merely,"—it might perhaps better be "not chiefly,'—"to develop the artistic powers of the student, but to lay that foundation of knowledge without which there can be no true art." Architecture is a fine art, based upon a mechanical art. Before the architect can become a true artist he must be master of the art of building. He need not be ordinarily, he cannot be, a mason or a carpenter or a stone-cutter. But he must know how to design good masonry, and good carpentry, and be able to pass judgment upon completed work.

He must also, to meet the demands of the present time, which in the main are just, be a man of science—that is, he must know the scientific principles of buildings, the laws of mechanics to which structures are amenable, and the application of those laws in designing architectural structures. Then there are certain trades whose work is commonly essential to the comfort or protection of buildings, which he must, therefore, condescend to recognize, such as painting and plumbing. The latter, if one may judge from the prominence given to it in architectural journals, is of immense importance. There was a period, just ended, when, on both sides of the Atlantic, it might have been inferred, from the leading articles in some of those papers whose special function it is to disseminate a knowledge of architecture and the allied arts, that the one thing that the student should acquire, and the aged practitioner, too, if his early education was neglected, is a knowledge of traps, their nature in general, their particular forms, their uses, the materials of which they are composed, the mysteries of their operation, the derangements to which they are liable, and the dangers that lurk unseen in their hidden depths. When these, and some other matters are disposed of, the architect may turn his attention to designing, which is his particular art.

Let me state the proper subjects of study under the following heads: Building, Mathematics, Mechanics, General Sciences, History of Styles, Drawing and Designing, and Languages.

How much of each of these is it necessary for a thoroughly-equipped architect to know? How much knowledge of each can be communicated in a school? Your programme calls for short papers, and I shall give you only an abstract of the longer document that I would have been glad to offer.

1. *As to Building.*—It is evidently impracticable, for want of time, to put the student through a course of practice in masonry, carpentry, and the like. We cannot train him in the manual of the shovel, the hod, and the hoe, nor oblige him to dress stone and lay it by line, level, and plumb, each piece on its natural bed and all properly bonded; we cannot make him an expert in the use of planes, saws, chisels, and such like. It would do him no special good if we could. It is not necessary that a man should be able to do certain work in order to gain a knowledge of it and be a judge of it, as all critics will maintain; nor will the ability to make a door be of any particular use in enabling a student to design a door. He can learn how a door is made by seeing somebody else make it, or from instruction in a class-room. By the use of his eyes and his ears he can learn all that he need know of the process of building. Shop practice, in my judgment is time thrown away, unless it be taken as physical exercise. The object of a course in architecture is not to make skilled mechanics. As to plumbing, steam-heating, electric-lighting, etc., things which do not materially affect the planning of the building, nor in any way the character of the design, there are certain general principles of arrangement and operation that can be systematically taught, and a multiplicity of details that can be learned only by examination of apparatus and inspection of work in progress. Here, as in the case of masonry and carpentry, lectures and text-books are to be supplemented, illustrated, enforced, by visits to buildings in which the mechanics can be seen at their work. When once the student has learned how any particular kind of work ought to be done, he is capable of specifying it, and of deciding whether it is good, bad, or indifferent. The instruction in these subjects comes under the heads of Construction and Specifications, which should go together, and be begun early in the course. Fortunately, there are several excellent text-books on these subjects.

2. Mathematics and mechanics may be spoken of together, as the required amount of the former will depend upon the use to be made of it in the latter. The mechanics of architecture, properly presented, is not an intricate or difficult subject. It is is simply the statics of rigid bodies. Dynamics, phoronomics, kinematics, hydrostatics, may all be omitted. They are necessary to the engineer, but not to the architect. Under "Strength of Materials" the laws of tension, shearing, compression, and transverse strain must be explained; but they may be expressed in formulæ which involve no other mathematics than arithmetic and algebra, and the application of these to ties, struts, beams, and piers is very easy. For analytical investigation, however, geometry, trigonometry, analytical geometry, and the calculus will be necessary. But if the student may be allowed to content himself with the results of other men's labors, if he does not care to rank as a man of science, and find out how the results were obtained, he may very properly dispense with analytics and calculus.

As a matter of fact, when he gets into the practice of his profession, he will never use them. If he wants a rolled-iron I-beam to carry a given load, he will not proceed to design one with scientifically proportioned flanges and web. He will take a manufacturer's table and pick out one that will answer his purpose. The maker guarantees the strength of the beam, and the architect troubles himself no more about it. If he designed it according to the accepted formulæ, he would use a factor of safety which one of our engineers has happily named "a factor of ignorance." It is best, of course, that a student should understand the theories of things, but it is not necessary. And furthermore, owing to the lack of homogeneousness in the materials we use, the factor in the formulæ which is derived from experiment on small pieces of comparatively perfect stuff may be entirely unreliable in the case of large pieces. For example, we have recently learned, on our side of the water, that the average strength in wooden beams taken from the lumber-yards is very much less than the commonly accepted formulæ would allow.

In the determination of the strains in beams and trusses, and the line of pressure in piers and arches, the graphical method has, for practical purposes, superseded the analytical, and it is so simple that any one may use it and be made to understand the principles on which it is based.

3. *As to General Sciences.*—Physics must, of course, be the beginning of any studies in science. The other necessary branches are chemistry, botany, geology, and mineralogy, the uses of which, in a course of architecture, are too obvious to require explanation.

4. *History.*—An architect, like any other professional man, ought to know what has been done by those who have preceded him. This knowledge he will get by the study of architecture in the historical order. The field is a vast one, and it takes a long time to traverse it thoroughly. But there are many books on the subject. Why not, then, let the student gain his knowledge by reading, rather than by instruction given in a school? Why is a teacher necessary?

My answer to these questions is that the book which will give full, correct, well-arranged information on the subject is yet to be written. The popular histories are usually either limited or superficial. Fergusson's, which contains a very valuable collection of examples, is imperfect, badly arranged, unsatisfactory in the treatment of important details, and padded with his theories and criticisms. What the student wants is a clear, complete, well-illustrated statement of architectural facts. Theories are interesting, but at this stage of his education they will do him little good. Criticisms will tend to bias his judgment, and prevent the free exercise of his taste when he is more mature. He wants to know what the Egyptians, and the Greeks, and the Romans, and all other people have built, when, why, and in what manner. He should make himself acquainted with the constructive devices employed, and their application to various classes of building. All is plain enough in the books generally, so far as the Classical period is concerned; but when the student comes to Byzantine and Romanesque, he needs a guide, and a much better informed one than has yet written a book. The earlier authors will probably tell him that those styles are mere degraded Roman, and not worth his attention. The latter ones will admit that they are interesting as phases of art, but that there is little to be learned from them—at least for any purposes of modern use. Mr. Fergusson, so far as he understands them, does them justice. But no writer seems yet to have discovered the fact that the time included between the years 400 and 1200 is the great period of architectural invention. We are taught to regard the Gothic architects as the most inventive. But what is there, among features that may be called constructive which appears for the first time in Gothic? Really scarcely anything but tracery. Buttresses, both common and flying, rib vaulting, pointed arches, compound piers—all were in use long before there was any Gothic architecture.

As to the proper historical status and logical position of Romanesque, your Oxford professor of history, Dr. Freeman, has pointed out the fact that it, and not Roman, is the true representative of the arcuated system. Roman is really a transition from Greek to Romanesque; and I do not hesitate to say that I regard the Romanesque period as the one upon which the student should receive the most careful instruction. But when he looks into his books he finds them lacking in the very points that he wants to know about. The use of the compound vault in Roman architecture was limited to two or three forms.

The Romanesque builders employed many more. What were they? Is there to be found in any history any approximation to a complete statement of the varieties, their geometrical development, their geographical distribution? The Byzantine architects (Fergusson says the Roman, but neither he nor any one else has proved it) devised a pendentive for making the transition from the corner of a square to a quadrant of a circle so that a dome might be made to cover a square space. The western architects modified this so that it might be carried on pointed arches. They also invented numerous other forms for getting from the corner to a straight line above, so that an octagonal vault might cover a square room, or an octagonal spire be placed on a square tower. Now, let the student turn to the histories and see what he can learn about pendentives. He will find that the information is very scanty. There are a few examples, but no one has gathered them together and classified them. Many forms are evidently unknown to the writers. Allow me to develop the forms of pen-

* A paper read at the Conference of Architects, London, May 4, 1887.

dentives descriptively. It will not take long. The subject is almost entirely, as to form, a matter of geometry. Take first the preparation for an octagonal vault. A heavy stone slab may be laid across the corner if the scale of the building is not too large, and the job is done. Or a series of advancing corbel tables may be used on any scale. If the corners of the corbel courses be cut away to form a continuous plane surface, the pendentive may be regarded as an inverted triangular pyramid.

If the surface of this be curved on an arc of a circle vertically, a cylindrical surface is produced; if horizontally, a conical; if both ways, a spherical or spheroidal. There are also irregular forms, such as a transition from a cone to a half-dome. The same end may be attained by throwing arches across the corner—your familiar English squinch. To get to the quadrant of a circle a form is first employed whose surface is that of a sphere whose diameter is the diagonal of the square to be covered, or something more. This is adapted for being carried by walls or by segmental or semicircular arches. By means of it a dome may be used to cover a polygonal space of any number of sides. When a spherical pendentive is to be supported by pointed arches there is a geometrical difficulty. The surface, if accurate, would be composed of two spherical surfaces intersecting at an obtuse angle, and the line of intersection would have a reflex curvature at the top, as Sir Gilbert Scott has stated. But neither the angle nor the reflex curve has ever, so far as I am aware, been found. Sir Gilbert suggests, if I remember rightly, that it was obliterated by rule of thumb. In France, however, the problem was geometrically solved simply by taking the pendentive surface from a convex, conoid, or pointed dome instead of from a sphere. The above is an instance of what may be done by an instructor to aid a student in getting a clear, systematic, comprehensive knowledge of an important constructive device, which the books fail to explain.

The history of architecture should unquestionably be a leading feature in the instruction provided for in the course, and should be taught, in my judgment, not from any text-book, but by means of lectures carefully prepared, so as to cover all necessary points and eliminate what is superfluous and irrelevant. These will be illustrated by photographs, drawings, lantern slides, and colored prints, and for the detail of structural forms, which I regard as all-important, by models. Unfortunately such models are not to be found. The Five Orders, ornamental work in relief, and such like, are abundant; but models of domes, of vaulting (excepting the simpler forms), of pendentives, of the methods of making or covering the transition from the corner of a tower to the side of an octagonal spire, of corbelling from the side of an octagon to the corner of a square above, of the varieties of cusps, and of many other things, are not to be purchased. I have a collection of two hundred and more, most of which have been made by myself or under my direction. They are invaluable, as a model is usually worth any number of drawings for purposes of illustration.

5. *Drawing and Designing.*—Drawing, both instrumental and freehand, being the architect's means of expressing himself, should be taught with great care. Accuracy and clearness are the points to be insisted on. Every line in a drawing should mean something, and its meaning should be plain. Descriptive geometry, the science of drawing, is of the utmost importance, and the student must be thoroughly drilled in it, as he will have to apply to it in stereotomy, in perspective, and in finding the limiting lines of shades and shadows. It is not necessary to make every student a fine draughtsman; but it is necessary that he should be able to draw with unfailing precision. Rapidity is desirable, but may be regarded as merely an accomplishment, though it has a commercial value. As to the higher art of painting in water-colors, while the class ought to have some instruction in it, few will take to it readily, or become experts. I would include it in a course, but not always require it. There are many, who will become good architects, that will never learn to make a passably good colored perspective. In fact, according to my observation, the best draughtsmen do not make the best designers. One who is intent upon expressing an idea will not stop to refine his means of expression.

As to designing, there are those who question whether it is possible to teach it. It is often considered as one of the things the power to excel in which is a special gift, the prerogative of genius. Doubtless there are men who will become good designers without training in a school, and there are some whom no amount of training will make skillful; but the average student can be taught the elements of the art in such a way as to develop his latent power. I have been astonished at the progress made by some of the bright young fellows under my charge.

As to languages it is not practicable to require more than a year of French and a year of German, or two years of one. It would be better, I think, that the student should have Greek and Latin, which furnish most of the terminology of architecture, than any modern languages, but they are ruled out of the "new education" for scientific and practical ends. If taught in a course in architecture a considerable advance in them should be required as a condition of entrance. As to a choice between French and German, I incline decidedly to the former, if for no other reason than that it will enable the student to consult the best work on architecture ever written, Viollet-le-Duc's "Dictionnaire Raisonné." Until that is translated into our tongue, no English or American architect who aspires to any approximation to a full outfit for his profession can afford to dispense with the knowledge of French.

A few words in regard to the practical results of the efforts which our schools are making to teach architecture. Students who graduate from the four years' course are enabled at once to get employment. Their acquirements in drawing, designing, and mathematics make them particularly useful to their employers, and they commonly get rapid promotion. Whatever can be learned in an office they are peculiarly well qualified to profit by. Their habits of study lead them to investigate anything that on first presentation may not be quite clear. Their education has given them a power of absorption and assimilation by which they take in and digest knowledge from every available source. They soon learn the business methods of an office, and, after two or three years of service, may safely venture upon the practice of the profession.

SUB-SURFACE WATER-SUPPLIES.*

BY PROFESSOR W. P. TROWBRIDGE.

TWO OR three years ago I prepared a paper for THE SANITARY ENGINEER, describing the driven wells, and the method of connecting them with pumps, by which a large supply of pure water had been obtained for the city of Brooklyn from the gravel deposits on Long Island. The simplicity of the means adopted, and the large and constant volume of water obtained, were alluded to as constituting a new and successful experiment on a large scale in connection with the supply of water to towns.

Since the publication of the paper referred to, the Messrs. Andrews & Co., contractors, have established two additional "plants" along the line of the Brooklyn Aqueduct, increasing the supply for the city to eighteen millions of gallons daily from this source alone—a quantity equal to one-sixth of the supply to the city of New York at the present time.

This large volume of water is obtained from four hundred and sixty (460) 2-inch tubes (equivalent in area of cross-section to a single tube or pipe 44 inches diameter) driven from forty to seventy feet into the gravel deposits. On a trial-test, these tubes have furnished twenty-seven millions of gallons in twenty-four hours. Eighteen millions is not, therefore, the maximum supplying capacity of these wells at this time.

It is not contended that there is anything novel in the idea of obtaining water for any purpose from the unconsolidated or loose detritus of the earth's surface; but the means and appliances, by which large quantities are drawn continuously and permanently from a few tubes driven into the ground, are so effective and simple, and so much has been done to encourage further operations of the same kind, and to throw light upon the characteristics of these underground water-bearing deposits, that it may be said that new resources, in connection with the water-supply of the largest towns, have been opened to the engineer—resources not *always* available, it is true, but in many cases highly practicable and economical.

The engineer who seeks a source from which may be obtained a proper supply of water for a town must take into consideration a great variety of circumstances. Among these, the meteorological and geological conditions which prevail in the district are most important, since these influence the quantity as well as the quality of the water obtained. Of all meteorological agencies, there are none which have more controlling influence on the physical geography of the globe, and the adaptation of any part of its surface to the necessities of the human race than those which relate to rainfall and the reflux of the condensed waters to the sea. The causes which determine the quantity of rain which falls in any region are various; ocean currents, aerial currents, mountain ranges, extended valleys and plains—all produce their effects; and, although the most varied extremes occur of regions where vegetation is luxuriant on the one hand, and where deserts exist without rainfall on the other, yet such is the constancy of nature in her great cycle of changes, that each place receives its appointed share almost unchanged from year to year.

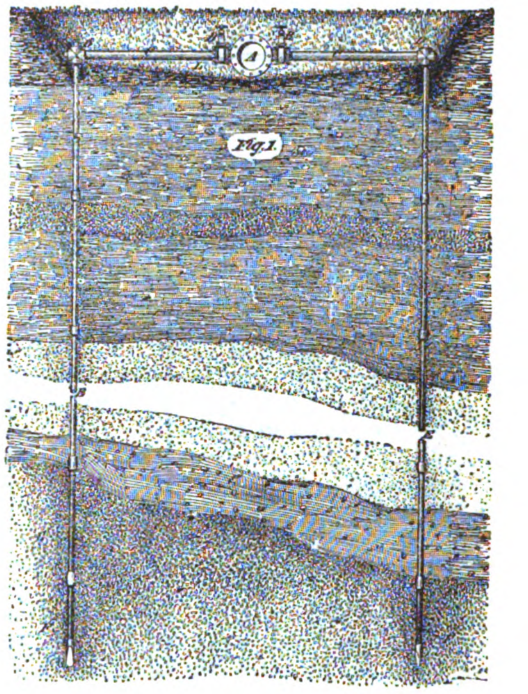
The average rainfall of a region is, therefore, in most civilized countries, one of the best established of all meteorological phenomena.

It is not so, however, in regard to the return of the waters to the sea. The flow of surface-streams may, it is true, be determined with approximate accuracy, and their courses are well defined; but the disposal by nature of that large part of the rain which does not appear in the rivers and brooks, as they accumulate in magnitude towards the sea, is involved in much obscurity. A portion of the condensed vapors is known to be absorbed by plants, and a portion is re-evaporated, but a still greater part, apparently, disappears beneath the earth's surface. By what precise channels this large volume of water ultimately reaches the ocean, how much of it enters the covered outcrops of porous strata and finding its way deep into the earth's crust between underlying and overlying consolidated beds, is ultimately discharged underneath the waters of the ocean; how much enters faults and fissures, and again issues in springs of pure or mineral waters; how much is concerned in excavating underground courses through or among the softer or more soluble rocks, or follows channels already thus excavated, is not and cannot be known. But that no inconsiderable portion of this subterranean flow follows more shallow channels in the loose detritus upon the surface seems probable. In most countries where the rainfall is copious, moderate excavations at the surface reveal the presence of water. In our own country every farm has its well, whether it be situated on a hill or in a valley; and, while these wells occasionally become dry in very dry years, it is apparently, in most cases, because they have not been sunk deep enough to reach those water-bearing beds of gravel and sand from which a perpetual and continuous supply might be obtained. The farmer, in sinking a well, looks gratefully for the first indication of water, and as his needs are not excessive, the sinking of the well is stopped when the upper surface of the first water-bearing stratum is reached. The methods and appliances at his command do not permit him to sink deep into watery ground.

The "driven well" goes deeper, and the tube is easily driven through soft ground to any desired depth; while the artesian boring proper pierces the solid strata still lower, if necessary, and draws its waters from sources more distant than those which supply the common or the driven well.

The proportion of the rainfall which passes off by the surface streams is so variable in different places, that actual gaugings of the streams is generally necessary to determine it. Over a large portion of our Northern States, this proportion is from 30 per cent. to 90 per cent. of the rainfall, depending upon the seasons, the surface topography, and the geological characteristics of a district. From 10 per cent. to 70 per cent. of the rainfall for the same localities disappears, being absorbed by plants, re-evaporated from the surface, or sinks beneath it, and of this latter portion there is no doubt that, in many parts of our country, nearly all follows shallow sub-surface channels slowly to the sea-levels.

Artesian wells have become so common in every quarter of the globe as to no longer excite especial interest, beyond that which may be attached to the great depths of some and the large volume of flow from others. As a general rule the hard or consolidated strata of the earth's crust have to be pierced, often at very great depths, to reach water-bearing strata which have been pointed out by precise geological knowledge, or which are sought for with much expense and uncertainty where such knowledge is wanting.



While the mechanical processes of boring these wells have reached such a degree of excellence and certainty that individuals or companies may now be found ready to under take for a specified sum per foot the sinking of an artesian well to any reasonable depth, yet the great cost and the uncertainty of success of any one boring as regards the volume of water which may be permanently obtained, causes this method of search for water to be adopted for cities and towns only as a last resort.

If it be proper to classify the systems which have been referred to as the "artesian" and the "driven well" systems, it can be said of the latter that the methods of exploration and well-sinking which have been recently developed seem to offer incontestible advantages, and to promise results of the greatest value and importance. Facts have been established, in the explorations already made in different places, which seem to offer strong inducements for further and systematic researches, not only from an economic but from a scientific point of view. Among the scientific questions presented, those which appear to be of special interest relate to the causes of some of the peculiar phenomena of despotism and arrangement presented in the interstratified beds of gravel, clay, and sand which are found to exist; and, if these are connected in any way with ancient river-beds, the possibility of tracing out these beds with greater certainty.

A study of these surface deposits by the methods which have been introduced for the driven wells, and which is attended with little difficulty and expense, comparatively, seems to offer, at least, an attractive field for economic and scientific explorations.

Through the kindness of Mr. W. D. Andrews I have obtained sketches which illustrate the construction of one of the four "plants" on Long Island from which the supply above mentioned is obtained, and also a sketch illustrating the process of boring or prospecting adopted; and

* From the School of Mines Quarterly, April, 1887.

another representing a section of the deposits of sand, gravel, and clay in the vicinity of one of these plants to the depth of 433 feet.

In these sketches Fig. 5 represents a plan of the whole "plant." The system of driven tubes occupies a space about 800 feet long and 15 feet broad, parallel with the line of the Brooklyn aqueduct. The tubes are in two rows about 15 feet apart, while in each line the tubes are about 12 feet apart. Figure 5 shows the relative position of the Brooklyn aqueduct, M, the pump-house O, and the driven wells in two rows D D, Fig. 4. Figure 4 is an enlarged view of a portion of the plan. In this sketch it will be seen that each tube is connected with a large pipe A, lying midway between the two rows of driven tubes and connecting them with a central or common chamber H, from which the suction-pipe J extends to the pump-house. In this figure the connecting pipes C C and the junction B B are shown more clearly than in Fig. 5.

The pumps in the pump-house O draw water from all the wells simultaneously and discharge it directly into the aqueduct through the pipe N. (Fig. 5).

Figure 1 represents a vertical section through two driven wells, showing the extension of the tubes downward through several strata of sand and gravel to the lower stratum G, from which the supply is drawn. The ends of the tubes are pointed to facilitate them being pushed downwards, and are perforated for several feet in length near the ends to permit the entrance of the water; the perforations being covered with a wire netting to prevent the introduction of large pieces of gravel.

Figure 2 illustrates the apparatus for prospecting for water. A 2-inch tube is driven down for a few feet at the surface with fittings at the top which close the top, except that a spout shown in the figure is attached to discharge water, sand, gravel, and clay into a tub. These

Fig. 2

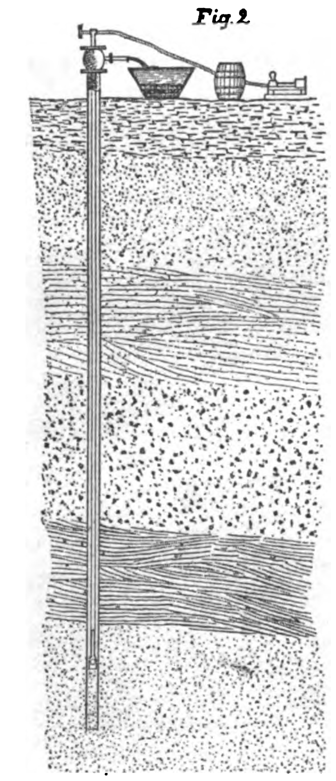
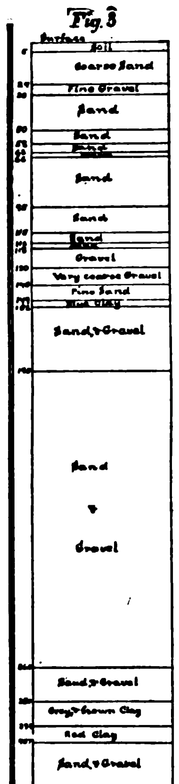


Fig. 3



fittings permit of a smaller tube being inserted into the top of the larger with a hollow handle connected with a flexible hose to a portable pump. A man by grasping this hollow handle can churn the inner tube up and down while water is being forced into it from the pump. The bottom of this inner tube is chisel-shaped, but there are two openings near the bottom which permit the water pumped through the inner tube to enter the space between the inner and outer tubes near the bottom. The churning action cuts up the sand and gravel, and as it is mingled with the water forced in, both the water and sand or clay are forced to the surface upwards between the two tubes and discharged into the tub.

A barrel or portable tank supplies the water if necessary. The specimens discharged into the tub are collected and preserved and thus a complete section of the strata may be obtained. The tubes may be extended by adding sections at the top as the boring extends downwards. Fig. 3 shows the section obtained near one of the plants on Long Island to the depth of 433 feet. Two of the gravel deposits passed through were composed of coarse rounded gravel, almost wholly free from any admixture of fine sand or clay, an evidence that there is a continued flow of water among the particles of gravel.

Mr. Henry E. Knox, Jr., formerly a student in the School of Mines, has been for many years engaged under the direction of the Messrs. Andrews in prospecting for water in various places, and I am indebted to him for the description of the prospecting device just described.

Mr. Knox found, between Albany and Troy, an extensive bed of gravel beneath a bed of fine clay, from 16 to 25 feet thick near the surface. The gravel bed is from 17 to 35 feet thick, about 700 feet wide, and of indefinite length, it having been traced about half a mile longitudinally.

The gravel from this bed is entirely different from that on Long Island. It is composed of coarser grains or fragments of dark-colored rock, nearly all of uniform size, and less rounded than those from Long Island, showing evidence of that kind of attrition which comes from running water rather than wave action.

Mr. Knox found precisely the same gravel in his explorations near Utica; and under a bed of clay, 118 feet thick, near Albany, he found a bed of clean gravel, of nearly uniform size and uniform material, but composed of angular, water-worn pebbles as large as pigeon's eggs.

One of the most important questions connected with the system adopted on Long Island, and which has been repeated elsewhere on a similar scale, was the permanence of a full supplying capacity of the wells.

It was urged by some distinguished engineers that the tubes must tap sheets or reservoirs of still water, and that a continued draught upon the system must speedily exhaust the reservoirs.

Experience has not confirmed this view. Mr. Knox informs me that, of the fifteen hundred or two thousand wells selected and driven by himself, not more than two or three have ceased to act, and that in nearly all the supply remains undiminished.

Experiments were made on Long Island to determine the line of depression of the water-level in the ground immediately adjacent to the plant of one hundred wells, while the pumps were drawing to their full capacity.

Test-wells were sunk just outside of the plant on four sides, and a line of test-wells extended out to a distance of 4,000 feet from the pump-house. Observations were made during three months. At the distance of 4,300 feet, the water-level was reduced about six inches; at a distance of 2,300 feet, about 2 feet 2 inches, and in the immediate proximity to the wells, within a distance of 300 feet, the depression was 4 feet 8 inches. When the pumps were stopped all the levels were restored.

The rate of flow to wells sunk in sand or gravel depends, of course, upon the compactness of the material of the water-bearing stratum, the resistance to the flow being proportional to the narrowness of the minute channels through which the water must flow, and to the number of windings and turnings which a particle is forced to take throughout its course to the pumps. The velocity of a particle of water running into an ordinary filtering gallery along the margin of a stream is generally less than one foot an hour. The velocity of a particle flowing towards the pumps in the driven-well plant on Long Island, taken a little outside the rectangle formed by the hundred wells, is about the same—a velocity too small to be directly perceptible to the eye. This small velocity shows what great relative resistances are encountered.

The form of the water-surface will, therefore, depend almost entirely upon the coarseness or compactness of the materials through which the water passes, and is not to be taken as a measure of the degree of exhaustion of the source of supply.

In all the explorations thus far made, it has been found that the gravel-beds, available for water, are not continuous over indefinite areas, nor of uniform thickness, but certain beds and particular channels in certain beds appear to constitute the underground waterways, rendering systematic explorations necessary.

The questions which naturally arise concerning these deposits are: What have been the causes of the peculiar arrangements of sand, gravel, and clay? Are the gravel deposits the beds of ancient water-courses, along which the finer sands and clays have been washed away by the streams? Can these old river-beds, if they exist, be traced and identified throughout their courses?

In the exploration between Albany and Troy, the appearance of the gravel found seems to indicate a common origin with that at Utica, and it is the opinion of Mr. Knox that the same beds extend along the valley of the Mohawk between these points, but by a route not identical with the present course of that river.

The mode of exploration, which has been described, renders it more simple and less expensive than might be imagined to conduct such researches, although not probably within the resources of private explorers.

An instance has recently come to my knowledge which adds new interest to this subject, inasmuch as in this case water was procured in abundance from a sub-surface deposit in loose material in a region where the small rainfall and the absence of permanent surface-streams has heretofore been considered a serious obstacle to any permanent settlement of the region.

Mr. Arthur Macy, a graduate of the School of Mines, having been appointed to take charge of the famous "Silver King" Mine in south-western Arizona, found that for the extensive milling operations that would be necessary in the treatment of the ore, an amount of water would be necessary for which no adequate supply appeared available. A valley of several miles in extent lay above the mines, and, from the appearance of the country, he concluded that this valley, from which flowed a small torrent in the rainy season, must contain sub-surface water. He excavated two open wells, one 15 feet, and the other 25 feet deep, at the outlet of the valley, and about 300 feet above his mills in vertical elevations and three miles distant from the mills.

A 3-inch pipe was carried from the mills up the valley to the wells, where it was connected to two syphons, one from each well; through these syphons, without the use of pumps, he obtains a continuous supply throughout the year of 200,000 gallons per day.

There is no doubt that Mr. Macy has thus discovered a practicable method of obtaining water in Arizona, which may be repeated in many parts of that Territory, and which will be found applicable in many other regions heretofore supposed to be practically deprived of water.

There is now at least abundant experience to encourage the search for and use of subterranean water for the most important uses of life in the shallow and loosely compacted deposits which cover plains and valleys. Another significant example is found in the new water-supply for the villages on the east shore of Staten Island. A large part of this island is known to be covered with drift. That portion which is embraced between the principal ridge of serpentine rocks running through the middle of the island from north to south, and the dyke of basaltic rock which skirts the western shore of the island, both of which have been described by Mr. Britton before the New York Academy of Sciences, is especially to be noted as bearing water—a very large part of the rainfall, doubtless, because the whole area of eight or ten square miles is peculiarly devoid of surface streams.

Along the south-western shore of the island there are unmistakable indications that the underground flow reaches the surface only a few feet above high-water mark. Here the Crystal Water Company have sunk large tubes about 40 feet into the drift. From these tubes the water destined for the village along the eastern shore of the island is pumped to a reservoir, 3½ miles distant, situated on the top of the dividing ridge referred to, whence it descends through pipes by gravity about 2½ miles further to the eastern shore, furnishing a head of about 250 feet.

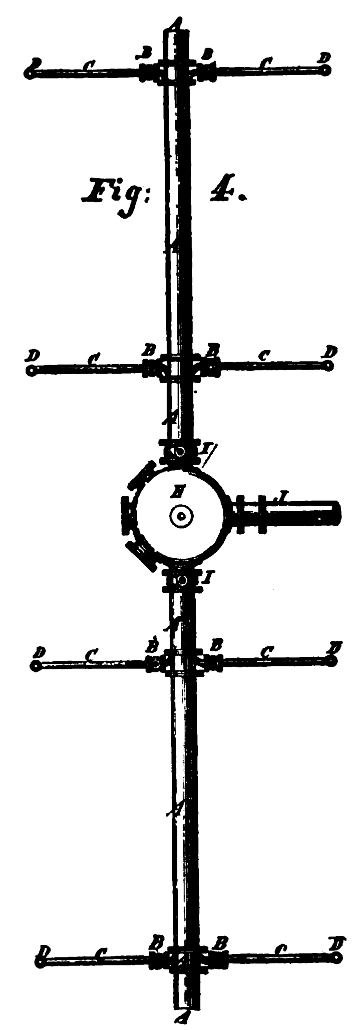


Fig: 4.

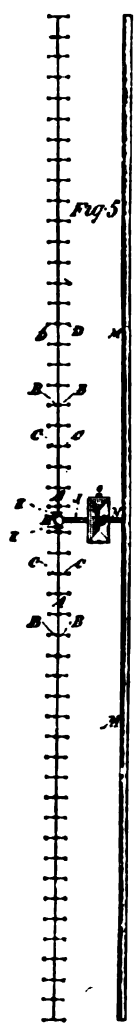


Fig 5

A few years ago Staten Island and Long Island were supposed to be almost destitute of water, when the prospective wants of their large and increasing population were considered. Now it may be said that in this respect, though isolated from the mainland, they are better off in many respects than New York City. I recently examined, at the request of the trustees of the village of Edgewater, the facilities presented on Staten Island, and had no hesitation in advising that a contract might be safely made with the Crystal Water Company for all the water which would probably be needed for a long term of years. Such a contract has since been made, and the water-supply for the towns referred to may be considered assured.

Perhaps my own interest in this subject is derived partially from some of the earlier associations of my life. In the State of Michigan, where I passed my boyhood, there is a tract of country twenty or thirty miles broad, bordering on the river and Lake St. Clair, the Detroit River, and Lake Erie, which is low and heavily woooded, and in wet seasons almost swampy. The settlers of this region had little difficulty in finding water a few feet below the surface, but there were few surface streams, and I have known the farmers to be obliged in very dry seasons to drive their stock several miles daily to water. A belt of country north of this and stretching from Lake Huron in a south-west direction quite across the State to Lake Michigan is covered with the most beautiful little lakes of pure and sparkling water—lakes which never become stagnant and never dry up.

Farther north again toward the northern part of the State, are found extensive pine barrens, where again there are but few rivers and streams; but I have seen wells driven there from 6 to 10 feet only to an abundant supply of water. The little lakes I have referred to are replenished from the exposed outcroppings of gravel-beds, and while they are often linked together so as to constitute the sources of considerable streams, the water from most of these lakes seem to sink away slowly again and to flow underground in broad sheets toward the great lakes. Nearly everywhere in this State water in abundance can be found by driven wells, and I am told that in the regions where the early settlers suffered so much from swamps and mud in winter, and drought in summer, surface-drains and tube-wells have created an entirely new condition of things favorable to the farmer.

An objection has been frequently urged against the use of water from these shallow sub-surface deposits that there is danger from pollution or contamination of the water by sewage and surface drainage, the drainage from cemeteries, etc.

While it would obviously be undesirable to establish a driven-well plant within the limits of a populous city it may be said that the necessity for so doing is never likely to occur. Moreover, the purifying influence of the soil by infiltration is known to be very effective; the well-known processes of sewage disposal by irrigation and downward filtration are based upon this property of the ordinary porous soils.

A microscopic analysis of the effluent water from the irrigation fields of Paris showed that the number of microbes in the sewage was reduced from 20,000 per cubic centimetre to 12 per cubic centimetre, and that the effluent water from the irrigation fields contained fewer microbes than the water supplied to Paris for domestic uses. (See Gray's Report to the City Council of Providence).

The water being drawn from considerable depths, usually the purifying effect of the slow downward filtration from the surface would probably be much more complete than is produced by any artificial filtration.

It should be a source of public congratulation that while our rivers and and streams must become polluted by a growing population nature furnishes another source of water-supply so abundant and widespread, so pure and so easily procurable.

Explorations and investigations having in view the more thorough study of this underground water-supply deserve, and should receive at the hands of the public the most earnest appreciation and encouragement.

SOME REMARKABLE BREAKS IN THE RESERVOIR ON CONSHOHOCKEN HILL.

At the regular meeting of the Engineers' Club of Philadelphia, May 7, 1887, President T. M. Cleemann in the chair, nineteen members present, the secretary presented on illustrated paper by Mr. Lewis N. Lukens upon some remarkable breaks in a reservoir.

"The reservoir was built it 1873, on the top of the Conshohocken Hill, about 200 feet above the level of the Schuylkill River, from which the water is pumped. In plan it is a square of 151 feet at the top of the embankment, with a division embankment rising half way to the top of the side walls. When ordinarily full it holds about 1,000,000 gallons.

"The earth of the locality is of a rather light character, with enough talc in it to make it feel rather greasy. The general rocks of the locality are limestone, and the variety quarried and sold as Conshohocken stone. The exact geological conditions of the locality I have not knowledge enough to describe.

"In constructing the reservoir the banks were raised about as much above the natural level as the excavation was beneath it, the earth for the excavation being used for the embankments. These were well rolled and allowed to settle as much as possible in the course of construction. The bottom and sides were then lined with 18 inches of stiff fire-clay, put on in layers of about 3 inches, each layer being well rammed. Above this there was put a brick pavement and this was washed over with hydraulic cement.

"The inlet and outlet pipes were cast-iron pipes laid in masonry. This masonry was composed of ordinary undressed stone, laid in hydraulic cement and extended out to about the middle of the embankment.

"The reservoir was finished in the fall of 1873, and water was let in soon after. In December, 1873, only a few months after the water was let in, the first break occurred. This break commenced just above the outlet-pipe and followed the line of the pipe through the embankment, laying bare some of the masonry described as surrounding the pipe. It broke through the embankment just about at the natural level of the ground, and was about 15 feet across at the top of the embankment, narrowing, of course, towards the bottom. The curious part was, however, that instead of the ground below showing evidences of such a large body of water passing over it, it showed that only a comparatively small part of the water had escaped that way and covered the low land just below. The larger part of the water must have escaped by some other channel, necessarily a subterranean one. This first break was repaired by filling in with stiff fire-clay and finishing as before. In the summer of 1876 the second break occurred. This was in the middle of the west compartment and was an absolute giving way of the bottom, there being no break in the sides. It was simply a hole of about 25 feet in diameter and of indefinite depth. A line was let down at least 85 feet without finding bottom, and stones thrown in seemed to rattle down indefinitely. The ledges of rock seemed to be inclined toward each other, thus V, and the slippery talcous earth had been washed from between them, nobody knows where. Whether the water from the first break started it is, of course, not known, although it seems, at least, possible.

"In repairing this, the crevices between the rocks were filled up and arched over with masonry, going as deep as necessary to get a solid support for the masonry—in one case as much as 34 feet below the bottom of the basin. The hole was then filled in with stiff clay and iron ore screenings, principally clay. The top was then planked over with hemlock planks, and the clay lining rammed down and covered with brick, as before.

"In the spring of 1879, three years after, the third break occurred. This was in the other compartment, taking away part of the partition wall and part of the bottom, and was a good deal like the preceding one. An interesting fact is that a well near by, 80 feet deep, and which had had 8 or 10 feet of water in it, was completely emptied the night the break occurred and has not held any water since. There must have been some underground channel by which the water from both found its way to the river.

"This hole was filled up with masonry and clay, like the other. The clay lining was then taken off, and the whole basin—sides, bottom, and partition embankment—were planked over with heavy hemlock plank. The clay was then put on again to a depth of 14 inches, and the whole surface bricked, as before. This time it lasted for eight years, until last fall, when a small break occurred. Some small quantity of water had washed the earth from between two rocks, in the side of and near the bottom of the end embankment, in the same old way. The weight of the superincumbent water had then sprung back the side planks, and the water had escaped by some underground channel. Being relieved of the weight the planks had sprung back. The fact of the springing back and subsequent release, is shown by there being a number of small fish caught and crushed in the cracks. This was repaired, as usual, by filling in with fire-clay, and at that particular place there is now 3 feet of fire-clay rammmed in between the rocks, then the planking, then 14 inches more clay, and then the brick lining. It is hoped now that it will last."

Captain S. C. McCorkle exhibited a map of the rivers in the vicinity of New York, made for commercial purposes, and refered to the proposed preparation of a simliar map of the rivers in the vicinity of Philadelphia, requesting the discussion of the subject by the club.

It was suggested that the Schuylkill River above Fairmount Dam be included in the survey and plan, as a great convenience to some 1,500 members of the Philadelphia rowing fraternity, but Captain McCorkle stated that the Government work could not be extended above tide-water.

It was also suggested that it would make the map more generally useful if the streets and other topography were extended across the city or farther inland, instead of, as in the New York map, only showing the wharves, piers and other water-front lines.

The discussion was adjourned and its further continuance is invited.

RELATIVE ECONOMY OF MACHINE AND HAND DRILLING.

At the meeting of the Engineers' Club of St. Louis, May 18, 1887, President Potter in the chair, twenty-one members and two visitors present, J. N. Judson and N. W. Eayrs were elected members.

Mr. R. E. McMath, Chairman of the Committee on National Public Works, made a report stating that no recent progress had been made. On motion, the report was received and the committee discharged. Mr. McMath was directed to remit to the treasurer of the National Committee the funds in hand for that specific purpose, and to express to the officers of that body the sentiment of the club on the subject—which is not favorable to further agitation of the matter at present.

Mr. H. A. Wheeler then read a paper on "The Relative Economy of Machine and Hand Drilling." The subject was carefully reviewed, and the various factors entering into the problem were explained and discussed. A comparison based upon results in St. Louis limestone quarries showed an economy of twenty per cent. in favor of the machine. A comparison of work at the Conglomerate Mine showed, in drifting, five per cent. in favor of the machine, but in sinking, hand-work showed a superiority of twenty per cent. The comparisons were made upon the relative cost per foot of hole drilled, and did not include the factors of quantity of material removed, speed required, and ventilation. The value of each of these factors could only be determined by an investigation into the special requirements of each case. They should always receive attention, as they have an important bearing on the problem.

The discussion was participated in by Messrs. Holman, Melcher, Seddon, Moore, Potter, and Stockett.

The question of the relative cost of mining coal by machine and by hand was also brought up. It was stated by Mr. Stockett that he had accumulated data showing fifteen to twenty per cent. economy in favor of the machine.

REPORT OF THE CITY ENGINEER OF OMAHA FOR 1886.

Mr. Andrew Rosewater, the City Engineer of Omaha, in closing his term of ten years of office, writes a very interesting report. He refers to the early surveys and the controversies as to lines and boundaries; to the topography and the makeshifts for drainage; to the diversities of opinion as to grades, leading to two parties, etc. The town was laid out in 1854. The first and only topographical map was made by him in 1873. The surface-grade party, which at first carried the day, were gradually overborne, as the citizens learned the evils and difficulties in the way of steepness, etc., attending them.

In 1873, also, the first scheme of sewerage was approved. Up to 1881 only 3,362 feet of sewers had been built, and those were brick, and 5 to 5¼ feet in diameter. That year Colonel Waring submitted a plan for a separate system, the main to be from 15 to 30 inches, and laterals various sizes down to six inches. The writer details the criticisms to which all engineers are subjected—himself among them —who inaugurate a new work in any community. He thinks the Waring system, while meritorious, was extolled beyond reasonable limit, and "its faults kept from view."

He also claims that the separate system had been advocated forty years before in England, and that a plan had been made by Mr. Lowrie for Denver on this system four years before the details adopted at Memphis were patented. He says the system "is based upon a given population per house, and a specific number of houses yielding a specific quantity of house sewage, etc., per capita. All of these are inexact factors and in some cases fail, as in Omaha, where in two districts, owing to the use of water-elevators the average per capita is more than treble already in amount than was computed for it." He enters into this discussion at some length.

He considers the system meritorious where a cheap system is the only available one. Where steep grades render small sewers capable of carrying off large volumes rapidly, and where water is abundant, the combined system, with automatic flushing devices such as those in use in a large part of Omaha, he considers decidedly preferable. He considers an 8-inch pipe the minimum size that should be used on the separate system, and recommends manholes as air-inlets. For the combined system he has adopted untrapped catch-basins, and it has resulted "in a radical decrease of complaints of house-owners concerning sewer-gas." The only trouble they have had arose from the gas company having temporarily discharged their waste into the sewers.

In working out the combined system for a part of the city he provided for one inch of rain per hour, this being from one-half to one-third the maximum fall. The "oldest inhabitant" was, as usual, invoked to prove that the sewers were totally inadequate; but it was thought best to depend on surface drainage for any excessive rain, and save the million of dollars that would have been required otherwise in addition. No difficulty has been experienced in four years' use, except at a time when an embankment gave way and brought a large excess of water to the streets. There are now about 20 miles of sewers on the combination plan, and 30½ miles in all.

The water-works are described in a general way only. Settling-basins were built of Missouri River sand upon the theory that the sediment in the water would gradually fill the interstices and make them tight. This is true in part, but the winds and waves made it necessary to plant a dense growth of willows on the banks. The interior was, for cleansing purposes, lined with asphaltum, which has been economical and efficient below water, but masonry was found necessary above.

He points out the fallacy of the test so often specified of requiring a certain number of streams of given height and size to be thrown at once. This "makes no exhibit whatever of the duty or power of the pumps (if tested under reservoir pressure), but simply and solely tests the pipe system, the tightness of joints, etc." The best results will always be obtained when the works are new, and with almost no draft on the mains. A hydrant pressure of 75 pounds gives 56 pounds at the end of 100 feet of rubber hose with 1⅛-inch nozzle; and to get the same effect through 200 feet of hose requires 19 pounds more pressure. From these results he argues for the use of intermediate hydrants in blocks.

He gives, finally, an extensive review of the subject of pavements, which we hope to reproduce in substance in our series of articles on this subjeet. A number of maps accompany the report, together with cuts of sewer basin, flush-tank, of the viaducts built on Eleventh and Sixteenth Streets, etc.

THE MICROBE OF TYPHOID FEVER.

AT a recent meeting of the Société des Hôpitaux, M Chantemesse made an interesting communication concerning the morphological and biological characteristics of the typhoid microbe. The sporulation of this microbe takes place between 19° and 48° C. (67° to 104.4° F). It develops in water, even if sterilized. At a temperature of 45° C. (113° F.) the cultivations live for several days; they are destroyed by boiling. This microbe retains its vitality in damp ground. Corrosive sublimate (1 in 20,000) and sulphate of quinine (1 in 800) destroy it. Carbolic acid (1 in 400) has no effect on it; hydrochloric acid is also inert, therefore the acidity of the stomach is not inimical to this microbe. —*British Medical Journal.*

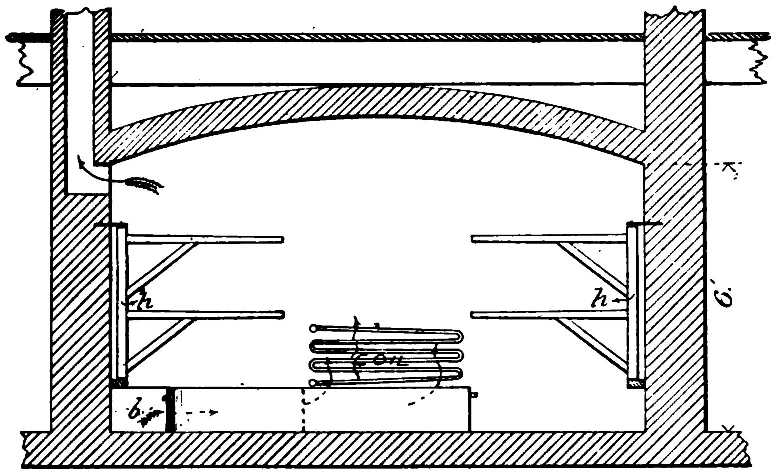
DOMESTIC ENGINEERING
PLUMBING HEATING LIGHTING & VENTILATION

AN AIRING-ROOM OF THE BUCKINGHAM HOTEL, NEW YORK.

IN looking over the appointments of the Buckingham Hotel recently, we noticed an airing-room, the particulars of which no doubt will be of interest to many of our readers, as the like is not often met with even in the finest appointed hotels.

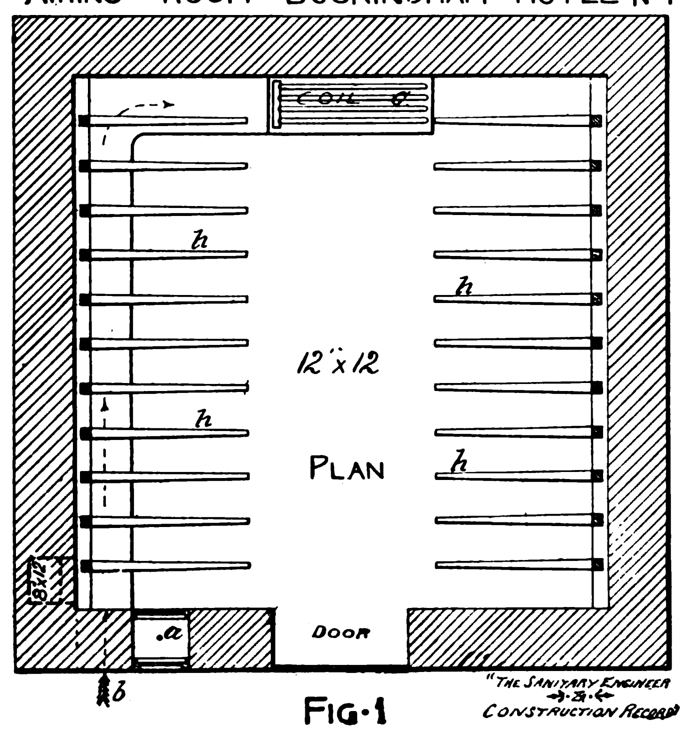
The object of an airing-room, of course, is to air clothing, bedding, etc., and in such case it becomes a disinfecting chamber to a certain extent; the lack of heat necessary to destroy the more hardy organisms being the only thing wanting in this respect.

In this hotel, however, the principal object of its use is to obtain what may be called absolutely dry clothing, particularly bed-clothing and underwear.



SECTION

•AIRING ROOM • BUCKINGHAM HOTEL•N•Y•



FIG•1

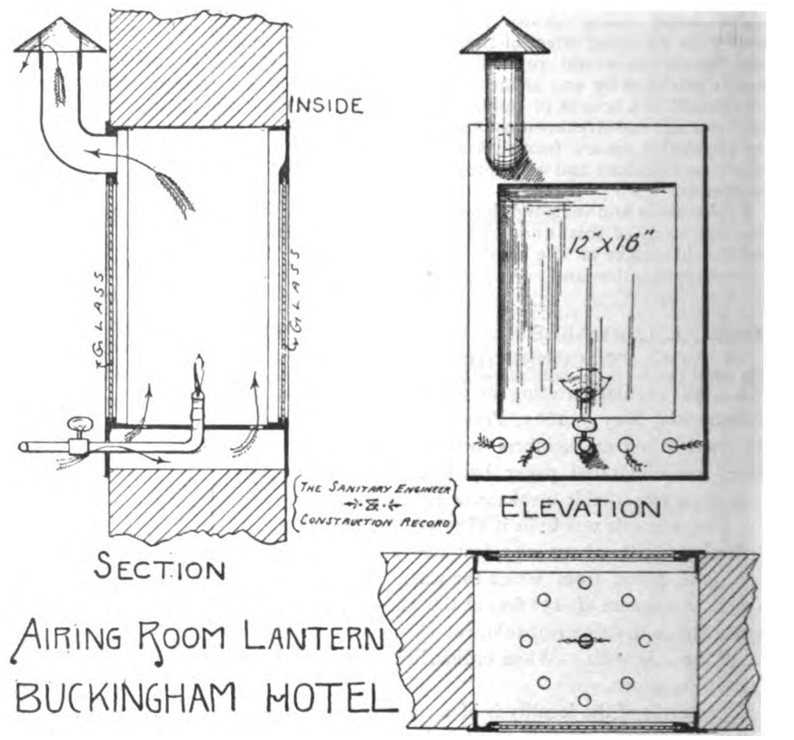
After clothing is ironed or mangled it is generally customary to hang it for a short time in the ordinary steam-warmed drying-room. But as the temperature of this room is often 130° Fah., and the atmosphere saturated to a very considerable extent, a dew-point is formed in the clothing when it cools to the temperature of the linen-room. It is to prevent this dew-point or dampness that the airing-room here illustrated was constructed.

The room is 12x12 feet by 6 feet high, with brick walls and ceiling, so as to be fire-proof in so far as not to communicate fire to the remainder of the building in case of the ignition of matches, etc., in the pockets of clothing or from fire by spontaneous combustion.

On each side of it are arranged 11 swinging bracket horses, with arms 4 feet long, making in all 44 brackets. These brackets are of wood, and when not wanted for clothing are turned against the walls to make room for more bulky articles.

A steam-coil *c* supplies heat, and the temperature of the room is maintained at about 100° Fah. Fresh air is taken in at *b* at a temperature and dryness due to the day, and thence passed through the galvanized-iron duct to the coil, where it is warmed, increasing its affinity for moisture. It afterwards passes to the vent-duct, shown in the side wall, where it escapes.

A gas-lantern at *a* in the wall admits light to the interior of the room and also gives an opportunity for observation from the outside. It is shown in detail in Fig. 2, and is glazed inside and out. The products of combustion of this lantern are not admitted into the airing-room, but pass outward by a ventilator shown; the air to supply the light being admitted through circular holes at the bottom, as shown. The architect of the building is Mr. Richard C. Jones, of New York. The engineer in charge is Mr. Thomas M. Ward.



NEW YORK PLAN

FIG•2

BURLINGTON, VT., PLUMBING ORDINANCE.

It is hereby ordained by the City Council of the City of Burlington, as follows:

SECTION 1. No person shall carry on the business of plumbing, unless he shall have first obtained a license and registered his name and place of business in the office of the city clerk, and notice of any change in the place of business of a registered plumber shall be immediately given to said city clerk.

SEC. 2. Before proceeding to lay or construct any portion of the drainage system of any building, the plumber having charge of the same shall file with the health officer plans and specifications of said drainage and plumbing to the satisfaction of the health officer. The said plans must be approved by the health officer before any portion of the work can be executed. Plans shall be approved or rejected with as little delay as possible, and they must be within two days from time of filing.

SEC. 3. On every street provided with a common sewer, the sewage from each building on said street shall be conducted into the common sewer. No privy-vault or cess pool for sewage will be permitted upon any premises situated on such street, unless upon permission of the health officer in writing.

SEC. 4. All drain and soil pipes, when within a building, and for a distance of not less than five feet outside the foundation-walls thereof, shall be of iron, with leaded or screw joints not less than four inches in diameter. They shall be supplied with a running trap of the same size and diameter of the pipe, placed near the foundation-wall, with an accessible clean-out.

SEC. 5. Whenever plumbing fixtures requiring connection with a drain or soil pipe are placed in the second story of any building, the drain or soil pipe shall extend out through the roof, open and undiminished in size, to a height of at least two feet above the roof, and there must also be a fresh-air inlet pipe, of a diameter not less than four inches, entering the drain on the house side of and near the said trap, leading to the outer air and opening at any convenient place away from windows.

SEC. 6. All soil, drain, waste, and supply pipes shall be concentrated as much as possible, protected from exposure, and in general so located as to be accessible for inspection at any time. If such accessibility be not practicable, such pipes shall be extra heavy pipes. Drip or overflow pipes from safes, or from supply-tanks or cisterns, and also waste-pipes from refrigerators shall not be directly connected with the sewer, but shall discharge over other trapped fixtures, or into the outer air. When rain-water leaders are connected with the house-drain or sewer, they shall be trapped beneath the ground with a deep-seal trap, and if placed within the house shall be made of cast iron with leaded joints. No brick, sheet-metal, or earthenware flue shall be used as a ventilation for sewer, soil-pipe, or waste-pipe. All iron pipes shall be coated outside and inside with coal-tar applied hot, or some other approved equivalent.

SEC. 7. Water-closets shall not be located in any room which has no direct communication with external air, either by a window or an air-shaft of sufficient size, except upon permission of the health officer in writing.

SEC. 8. Drain-pipes and other fixtures shall not be covered or concealed from view until after the work has been examined by the health officer, who shall be notified by the drain-layer or plumber when the work is sufficiently advanced for inspection. The health officer may require all plumbing when completed to be tested by the peppermint or ether test, and he shall condemn and order the removal of any defective material, or any work not done in accordance with the regulations, and with the plans by him approved.

SEC. 9. These regulations shall be subject to alteration or amendment at any time, but the health officer must not approve any plans for plumbing in conflict with the foregoing regulations.

SEC. 10. Any person who shall neglect or refuse to comply with any of the requirements of this ordinance shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be punished by a fine of not less than one dollar nor more than twenty-five dollars for each and every offense.

SEC. 11. Any plumber required to alter work because he has not performed it in accordance with plans submitted, or because it is not properly constructed, when required to repair or alter the same by the health officer, shall do so at his own expense.

SEC. 12. Any person feeling aggrieved by any order of the health officer, issued under the provisions of this ordinance, may appeal therefrom to the health committee of the Board of Aldermen of the city, by notice to that effect in writing, to be filed with the city clerk within forty-eight hours atter the service of the order; and the city clerk shall forthwith notify the members of said committee, and the health officer, of said appeal; and further proceedings under such order shall be stayed thereupon, until after the hearing of the appeal. The health committee shall notify the party taking the appeal, and the health officer, of the time and place where they will hear said appeal; which shall be as soon as practicable. And pending such appeal, no work shall be done by the appellant contrary to the provisions of this ordinance.

Upon hearing, the order of the health officer may be sustained or disapproved by a majority vote of such committee, and their decision shall be final.

In case the order is sustained, the appellant shall be allowed the period of forty-eight hours, after the decision of the committee, in which to enter upon a compliance with the provisions of said order.

In case of a disapproval of such order by the committee, the order shall, by virtue thereof, be vacated, and no similar order shall issue against the same party, for one year thereafter.

Read three times in Board of Aldermen and passed under suspension of Rule 11, May 7, 1887.

Attest, CHARLES E. ALLEN, Clerk.

Approved May 3, 1887.

WM. W. HENRY, Mayor.

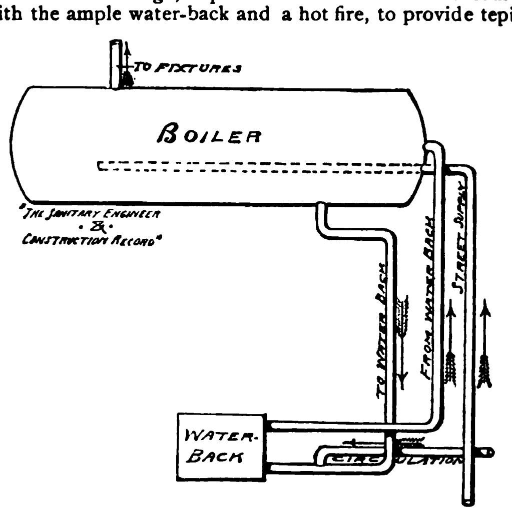
[There should be no qualification of the requirement to extend a soil-pipe full size through the roof. See Section 5. Under no circumstances should a soil-pipe be permitted to terminate inside a building.

A running-trap on a main drain is an objectionable form of trap to use. See comment in last issue on report of explosion in a drain of a London house. For proper form of trap (which is not patented), see "House Drainage and Plumbing Problems," page 218.]

DEFECTIVE HOT-WATER CIRCULATION.

HARTFORD, CONN., April 8, 1887.

SIR: A plumber has set a horizontal 40-gallon boiler over a kitchen range, as per sketch. It takes three hours, with the ample water-back and a hot fire, to provide tepid



water at the top of boiler, and consequently at the fixtures, which have a circulating-pipe. Hot water is absolutely unobtainable. The pipes are of brass, with ¾-inch bore. The pipe from water-back becomes very hot, but that doesn't affect the water in the boiler.

I claim that the apparatus will work all right if the boiler is turned upside down. Will it? If not, what would you recommend?

P. S.—Is there any difference in the hot-water supply from horizontal or from vertical boilers?

H., ARCHITECT.

[If the pipes are arranged as shown in your sketch there is nothing in the arrangement that should prevent your getting hot water and securing proper circulation. The trouble is probably due to some stopage in the pipes, either dirt, shavings, or some other obstruction. To turn the boiler upside down would make no appreciable difference. At any rate, we should first look for the cause of the stoppage in the pipes leading to and from the boiler. There should not be any difference, other things being the same.]

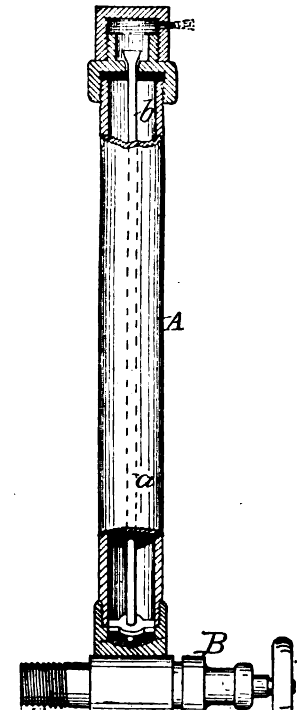
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and *it is to be distinctly understood that a notice does not imply approval.* No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

AIR-COCK AND AUTOMATIC AIR-VALVE COMBINED.

The accompanying sketch shows a novel combination of air-cock and air-valve combined, lately invented by E. P. Waggoner, M. E., and about to be put on the market by the Pierce, Butler & Pierce Manufacturing Company, of Syracuse, N. Y.

It consists of an ordinary differential expansion air-valve, in which the outside tube *a* is of brass and the valve-rod *b*



AUTOMATIC AIR VALVE AND THUMB COCK.

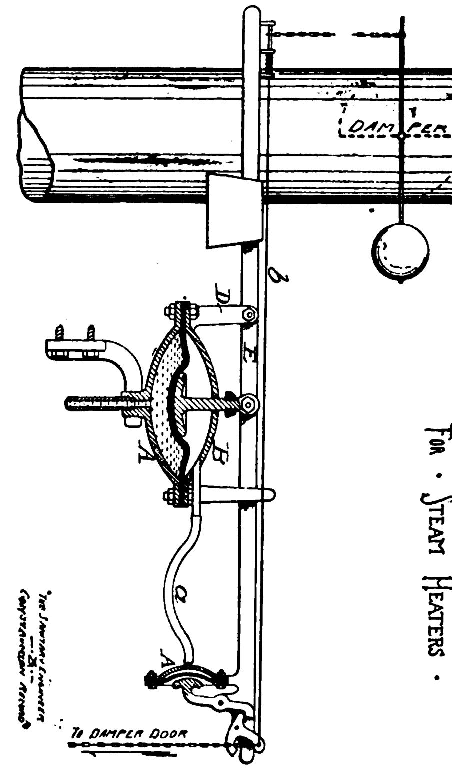
iron, the greater increase of length of the brass for the same increase of temperature causing the seat to move towards the valve relatively and thereby close it when hot. The invention, however, consists in combining the thumb-cock B with the valve A, the object being to allow persons to manipulate and draw off the air quickly without interfering with the adjustment of the valve.

If inquisitive persons are disposed to meddle with it, as they frequently do with similar devices, no harm can come to the apparatus.

REGULATING DAMPER-BOWLS.

The accompanying sketch shows a novel form of regulating damper-bowls and attachment, about to be put on the market by the A. A. Griffing Iron Company, of Jersey City, N. J.

It consists of an ordinary damper-regulator, to which is attached the secondary diaphragm bowl A, which rises and falls with the lever. This secondary bowl is attached to the bowl proper above the diaphragm by a piece of rubber hose *a*; the object of the invention being to provide a means of closing the doors and damper instantly upon the bursting or leaking of the diaphragm proper. To accomplish this the water or steam from the leaky bowl runs through the hose and inflates the second diaphragm, push-



AUTOMATIC DAMPER REGULATOR FOR STEAM HEATERS.

ing the catch off the bell-crank and letting the door-rod or chain fall. To release the damper in the chimney, a rod *b* connected with the bell-crank withdraws a bolt, letting the damper close. The inventor's name is not known to us.

Correspondence.

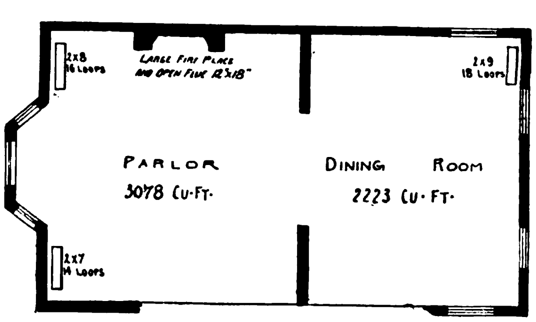
All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

EFFECT OF IMPROPER LOCATION OF AIR-OUTLETS ON WARMING.

——, MAY 10, 1887.

SIR: I take the liberty to ask you through your journal an opinion about heating two rooms. Over two years ago I fitted up a house with a hot-water heating apparatus with direct radiation; the apparatus circulates properly and the radiators heat up so hot that you cannot hold your hands upon them (probably 180° Fah.). The dining-room contains 2,223 cubic feet of space and the sitting-room 3,078, making a total of 5,301 cubic feet of space as per diagram. The rooms are adjoining each other with folding doors between; to heat this space, I put in three Bundy radiators, containing 48 loops. Reckoning the surface at 3 square feet to the loop, I have 144 square feet of heating-surface, or 1 in 37.

This party for whom the work was done complained that his house was cold, and has continued to find fault

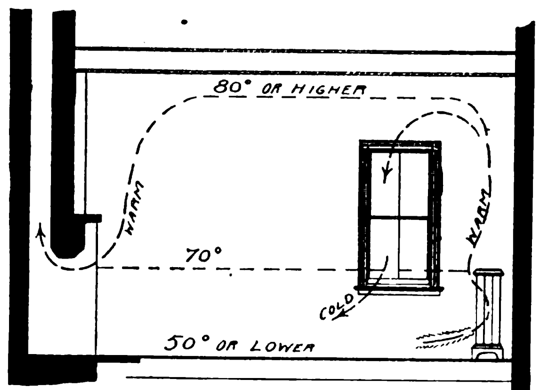


PLAN

since. Last week I made an examination of the house with the view of ascertaining the cause, and to my surprise was told that with the radiators all going in these rooms and a fire in the fire-place, they could not keep warm; to me this was an astonishing revelation. I then put my head in the fire-place and looked up the chimney and found that there was no damper or slide in the chimney, the size of the chimney being 12x18 inch. I remarked that it was impossible to heat this room with such a flue as that, drawing the air out as fast as it was warmed, and the gentleman was inclined to disbelieve it. I would like your opinion on the subject—that is, is it possible to warm a room up to a temperature of 70 degrees with that amount of radiating surface, when you have a fire-place in it and a flue running straight up to the roof and no damper in it? I

investigated some other houses that I had fitted up with similar apparatus, and found that in all the fire-places there were dampers. I incline to the opinion that the whole trouble is in this large fire-place taking the heated air out just as fast as it is warmed. Am I right? With kind respect, I am, yours, F. A. J.

[It appears to us that 1 to 37 is ample for hot water in houses where the windows are only at the front and rear or for average conditions. We would advise you, however, not to put a damper in the chimney, but to use a shield somewhat like a "blower" used in front of a fire-place to start the fire with. This shield should be a good fit at the sides and



·SECTION·

extend to within one or two inches of the floor only, leaving an opening of say half a square foot area at its bottom. The draught in the chimney will then draw the cold air from the floor-level, allowing the warm air to fill downwards into the room instead of going off at the level of the top of the fire-place.

The diagram Fig. 2 shows what is likely to be the condition of matters in the room with the large fire-place open. The cold air will remain largely at the floor and as high as the waist, while above the mantel the room may be warm. A damper in the chimney shuts off ventilation, and is not advisable.]

DELEGATES TO THE MASTER PLUMBERS' ANNUAL CONVENTION.

MASTER PLUMBERS' ASSOCIATION OF BOSTON AND VICINITY, BOSTON, May 24, 1887.

SIR: The delegates chosen to attend the National Convention at Chicago are: John H. Stevens, President; Isaac Riley, John Crawford, D. G. Finnerty, William H. Mitchell, James F. Dacey, Thomas J. Tute, E. G. Perkins, and Frank A. Titus. Yours truly,

FRANK A. TITUS, Corresponding Secretary.

ABOUT WATER-HAMMER.

BOSTON, May 23, 1887.

SIR: It has been suggested that I refer to conditions that sometimes produce water-hammer in street-mains of a water-works system. The following might, therefore, supplement what I said in my former communication—published in the SANITARY ENGINEER AND CONSTRUCTION RECORD of May 21:

The effects of the water-hammer are occasionally shown upon a larger scale when hydrant streams or blow-off cocks are suddenly shut off or when a gate is too hastily closed in the street-mains where the flow is rapid. But as such apparatus is, or should be, always made to open and close with a screw, and are, or ought to be, handled only by trained men, ordinary caution will prevent the occurrence of the water-hammer in street-mains. When water was first introduced in Boston, October 25, 1848, the event was celebrated with due ceremony on the Common. A public fountain was opened with a jet six inches in diameter, rising eighty feet in the air, to the delight of the assembled crowd. But the man who was sent to shut off the fountain after the celebration had not been fully instructed as to the effects of a water-hammer, and burst the main by closing the gate too quickly. Air-chambers to act as cushions are never used in street-mains, for the very good reason that no one gate is opened and closed often enough to make such a precaution worth while. Moreover, large gates cannot, from the nature of their construction, be moved very quickly. The mass of water which was moving rapidly in the mains toward the Boston fountain at the time referred to must have been a hundred tons or more; the discharge was voluminous too, and extraordinary precaution was needed to check the flow very gradually in order to prevent a shock. Such cases are very rare in street-mains, and the men in charge of them are generally aware of the risks of improper handling. Green firemen, however, are likely to do a good deal of damage by shutting off hydrant streams too quickly, and such duty should always be entrusted to men familiar with the apparatus. If the pressure is great, ordinary blow-offs and hydrants can often be closed more quickly than they ought to be, though this is not the case with large stop-gates in mains. The latter are heavy and are moved by slow screws.

EDWARD S. PHILBRICK.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
May 21	26.37	20.27	23.20	29.21	28.62	25.88	31.50

E. G. LOVE, Ph.D., *Gas Examiner.*

THE DRIVEN-WELL PATENT SUSTAINED.

THE United States Supreme Court decided two important driven-well patent cases this week. The Court holds that the grounds upon which it is sought to invalidate the reissued patent for the driven wells, as being for a different invention from that described in the original patent, cannot be sustained; that the invention had not been anticipated by others; and that there is a clear case of infringement. The validity of reissued patent No. 4,372, issued to Nelson W. Green, is therefore sustained. The effect of the decision is to render all users of driven wells not authorized under the Green patent liable to damages for infringement, who had them in use during the life of the patent, which was for the seventeen years succeeding the date of the patent, which was *January 14, 1868*, the reissue date being May 9, 1871.

REPORT OF THE DAIRY COMMISSIONER OF THE STATE OF NEW JERSEY, 1886. 99 pp., 8vo. Trenton. 1887.

Under the provisions of the New Jersey law approved March 22, 1886, entitled "An Act to Prevent Deception in the Sale of Oleomargarine, Butterine, or any Imitation of Dairy Products, and to preserve the public health," there is to be appointed by the State Board of Health a State Dairy Commissioner whose business it is to enforce the law. The officer is paid a salary of $2,000 per year, and is allowed to expend not exceeding $10,000 per year for the purposes of the act. Dr. W. K. Newton, of Paterson, was appointed under the act, and we have before us his first report, with appended documents. During the time embraced in the report 92 suits against violators of the law have been commenced, and in 36 of these judgments for the State have been rendered and penalties to the amount of $2,100 have been collected.

Dr. Newton is evidently active in enforcing the provisions of the law, which, in connection with the National law requiring all persons dealing in oleomargarine to take out a special license and pay a tax therefor, has, according to the report, greatly diminished the sale of this article of food within the State.

While we do not believe that the use of oleomargarine has been injurious to the public health, and think it unwise to base legislation against it on this ground, we approve the energetic administration of the law and compliment the State Board of Health on the selection they have made of the officer who is to enforce it.

The appended documents consist of a paper on "Oleomargarine, its history, etc."; a paper on "the Chemistry of Butter and its Imitations," by Professor H. B. Cornwall; a report on "Method of Separation of Coloring Matters in Butter, Imitation Butter, and so-called Butter Colors," by Professor A. R. Leeds; copies of the State law and of decisions by the courts in relation thereto, and a copy of the National law—the whole forming an interesting addition to the literature of this subject.

NOTES EMBODYING RECENT PRACTICE IN SANITARY DRAINAGE OF BUILDINGS. With memorandum of cost of plumbing work. By W. Paul Gerhard, C. E. Van Nostrand. Science Series No. 93.

This little book briefly and intelligently describes the essentials of house-drainage as recognized in the best practice to-day. Its chapter of maxims on plumbing and house-drainage are useful hints to assist an architect in preparing plumbing specifications, and it can be commended as reliable and useful.

By the same author is a pamphlet on "Fire Prevention, with special reference to hotels, hospitals, asylums and other public institutions." This matter was originally published in the Chicago *Building Budget*, and while not pretending to be an exhaustive treatise, is reliable as far as it goes and will be found useful to building committees and those planing or having the management of such institutions.

MESSRS. A. H. HOWLAND and George A. Ellis, Civil and Hydraulic Engineers, Devonshire Street, Boston, Mass., have issued a little volume describing their business; also, illustrations of several water-works built by them and a department of general information and tables relating to water-works. Among the tables are included one on safe heads, standard weights, cast-iron pipes, pressure of water, capacities of pipes, flow of water, etc. There is also an original table by Mr. Howland, showing the plunger displacement of the duplex pumping-engines. The book will be found very useful to any water-works official.

STRONG ARGUMENT IN FAVOR OF A SYSTEM OF WATER-SUPPLY.

LANCASTER, PA., is agitated over the question of improving its water-supply. The city received two preliminary reports, one from Mr. J. J. R. Croes, of New York, and one from Messrs. Wilson Bros. & Co., of Philadelphia. While these reports are under consideration, a citizen writes to the Council, and claims he has a scheme that is better than any yet suggested, and precisely what the town should adopt. He proposes to tell what his scheme is, provided the Council will pay him the sum of $500 and thirty years' interest, the principal having been paid by his father some thirty years ago as bondsman for a defaulting tax-collector. Heurges that as neither of the engineers had any ancestor who paid any money to the town for which they "got no value," they should not be employed. He says he is not an engineer, but his claim should be considered because of the sacrifice his father was compelled to make for the town.

CONNECTICUT CIVIL ENGINEERS' AND SURVEYORS' ASSOCIATION.

THE next annual meeting of this association will be held at C. E. Chandler's office, 161 Main Street, Norwich, Conn., Tuesday, June 7, 1887.

THE Society of Missouri Engineers and Surveyors will meet at Jefferson City, June 2.

THE Wisconsin Legislature has authorized the appointment by the Milwaukee authorities of a committee of experts to make a thorough investigation, and report on the sewerage problem of that city.

A MEMORIAL to the late Professor William Ripley Nichols, of Boston, has recently been published for private distribution. It is a deserved tribute to a man who, besides being prominent in his profession, was respected and beloved by all with whom he came in contact.

PERSONAL.

GENERAL JAMES L. SELFRIDGE, a veteran of the War of of the Rebellion, and recently Health Officer of Philadelphia, committed suicide last week Thursday.

SIR HORACE JONES, architect of the Royal Surrey Music Hall, the oak roof of the Guild Hall, and many other buildings in London, died May 23, in the 68th year of his age.

MR. OTIS A. MERRILL, of Merrill & Cutler, architects, of Lowell, Mass., will sail for Europe June 23.

MR. FRANK E. SHEDD, who has been construction engineer of the Washington Mills, at Lawrence, Mass, is now associated with Lockwood, Green & Co., of Newburyport, Mass.

MR. D. O. MILLS has given $50,000 for a building for a training school for male nurses. Messrs. D. & J. Jardine are the architects.

RICHARD ARTHINGTON GILPIN, C. E., died May 18, at Lima, Pa., in the 75th year of his age. Mr. Gilpin was in charge of the surveys locating the north-western boundary of the United States under the Ashburton Treaty.

MR. STUYVESANT FISH, of New York City, has been elected President of the Illinois Central Railroad Company, succeeding Mr. James C. Clarke, who has resigned.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

THE Commissioners of Chatham County, Geo., invite architects to submit designs of a Court-House building to be located in the city of Savannah.

The successful competitor will be charged with the execution of the work at the usual fee. Address John R. Dillon, Clerk C. C. C., Savannah, Geo.

THE Building Committee of the City Council of Los Angeles, Cal., asks for competitive plans until July 15, for a $150,000 City Hall. The successful competitor will be employed to superintend the construction, at the rates established by the American Institute of Architects. The second prize will be $150, and the third prize $100. The Council reserves the right to reject all plans, and will pay the author of the first premiated design $200 if it is decided not to build.

CONTRACTING INTELLIGENCE

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." *Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.*

For works for which proposals are requested, see also the "Proposal Column," pages 678-679-680 693.

WATER. SEWERAGE, ETC.

LITTLE ROCK, ARK.—Sewer District No. 11, on the Waring system, has been organized by the election of Anjelo Marre, F. M. Christman, and E. W. Kimball, as a Board of Commissioners, to whom all communications may be addressed.

ST. CLOUD, MINN.—The Council has ordered the full system of sewers for the St. Germain Street district put in at once, comprising seven blocks as follows: West, on St. Germain Street to Ninth Avenue; north, from St. Germain to the court-house; a block north and south from St. Germain Street to Sixth and Seventh Avenues; south, on Fifth Avenue to the middle of the West House Square, and south on Fourth Avenue, one block. This covers the most substantially built business part of the city.

CHATTANOOGA, TENN.—The City Council has passed an ordinance bonding the city for $50,000 for sewers.

SANTA CRUZ, CAL., will have sewers to cost $60,000, after plans by Col. George E. Waring, Jr., of Newport, R. I.

ST. JOHNS, MICH., will have water-works.

VAN BUREN, ARK.—A. L. Payne, of Richmond, Ind., has made a propositon to build water-works here.

FAIRBURY, ILL., will have water-works to cost $7,000.

BOWLING GREEN, O., is to have a water-works company with a capital of $25,000.

BEAUMONT, TEX.—W. A. Fletcher, J. J. Critchton, V. Weiss, and others are directors of the newly organized water company previously reported.

ASHLAND, WIS.—Chester B. Davis, C. E., of Chicago, is about to begin plans for the sewerage of this place.

GALLATIN, TENN.—Address Boyer & Russwurm in regard to water-works here, which project we have before noticed.

WATER-COMPANY.—The Hillsboro, Va., Water Company has been organized.

BOLIVAR, TENN.—Water-works will be built here by Austin Miller and others.

CHESTER, PA.—The Chester Water Company, newly organized, proposes to buy the South Ward's Water-Works.

PETERSBURG, ILL., is securing plans for water-works.

SHAWANO, WIS., is to have three reservoirs for fire protection.

APPLETON, WIS.—Will have a water-supply.

RHINELANDER, WIS., will have a system of water-works.

PORTLAND, ME.—The Portland Water Company is making surveys with a view to supplying Gorham with water.

WILMINGTON, DEL.—A new reservoir of the capacity of one million gallons is being constructed by Messrs. du Pont, de Nemours & Co., at what is known as the Sandhole Woods.

STANFORD, FLA., will have water-works constructed by the Stanford Water-Works Company. They are now building.

LANCASTER, PA.—The Committee on Water-Supply and Sewerage Improvement have employed Engineer J. J. R. Croes, C. E., of New York City, to perfect plans and specifications for the proposed improvement of the water-supply, and City Engineer Slaymaker is now making topographical surveys for the required data. Mr. Croes' plan was published, in summary, in a recent issue of this journal.

MANSFIELD, MASS.—It is expected that the recent petition to incorporate the Mansfield Water Company will be granted by the Legislature at its present session. The petitioners for the Mansfield and Foxborough Water Company have been given leave to withdraw.

CEDAR RAPIDS, IOWA.—Considerable engineering work is in progress and prospect here under the supervision of Chester B. Davis, C. E., of Chicago. In our proposal columns will be found an advertisement for bids for cedar block paving, of which there will be about two miles. The city has also instructed Mr. Davis to prepare plans for about $40,000 worth of additional sewerage and drainage work, for which bids will be asked as soon as the plans can be completed. Contracts were recently let for about twelve miles of sewerage.

TOWSONTOWN, MD.—The Towsontown Water Co. has secured ground for their reservoir. The Miller Artesian Well Co., of Baltimore, has the contract for boring the well and supplying the necessary pipes and materials.

WATER COMPANY.—The South-west Harbor, Me., Water Company has been organized, with the following officers: H. H. Clark, Esq., President; A. Allen, Secretary; J. T. R. Freeman, Treasurer. Directors, L. B. Wyman, Ellsworth, Joseph G. Parker, Jesse H. Pease, and S. W. Herrick, South-west Harbor.

INCORPORATED is the People's Water Company, of Philadelphia, Pa.

FORT SCOTT, KAN.—Comegys & Lewis, of New York City, who recently bought the water-works, will make considerable extensions after plans by their engineer, Colonel S. H. Lockett.

FRESNO, CAL.—Colonel George E. Waring, Jr., of Newport, R. I., has reported on a plan of sewerage, to cost $50,000.

PITTSBURG, PA., Councils have authorized the issue of $50,000 of bonds for sewerage-work.

CHEBOYGAN, MICH.—The State Senate has passed the House bill to authorize the village of Cheboygan to erect and maintain an electric-light plant and water-works.

HARTFORD, CONN.—Mr. Ezra Clarke, President, and Mr. Henry W. Ayers, Engineer, of the Hartford Water-Works, visited East Hartford on May 23 to examine the question of a water-supply for that place. The East Hartford Water Company has appointed a committee on plans for the supply. Dr. McKnight and Mr. Percy Bryant may be addressed in regard to the matter.

TOLEDO, O.—The subject of pure water is being agitated. The Committee on Water-Supply have had a proposition from Mr. S. P. Axtell, representing the Hyatt Filtering Co., who fixed the cost of a plant for filtering one million cubic feet per day at $15,000. Nothing has been decided upon yet.

LAKE GENEVA, WIS., wants water-works.

SYRACUSE, N. Y.—City Attorney Stone has submitted a lengthy report to the Common Council on the proposed franchise to the Onondaga and Salmon River Water Company.

WACO, TEXAS.—A second mortgage of $150,000 in bonds of the Waco Water Co. was filed May 21. There was one issued in 1884 for a like amount. W. W. Seley is the trustee in both.

FALL RIVER, MASS.—The Watuppa Reservoir Company and the Troy Mill have begun suits against the city to test the constitutionality of the Water Bill passed by the Legislature in 1886. The petitioners ask that the city be enjoined from taking any water.

ST. CLOUD, NEB.—It is reported that the City Council does not look favorably on the water-works proposition submitted by H. D. Upton on behalf of Eastern parties, and which we reported in these columns last week.

LANCASTER, PA.—Councils and the press are considerably agitated over the improvement of the city's present water-supply, which contemplates moving the pumping plant.

MILWAUKEE.—Among the new regulations to be adopted by the Board of Public Works as a result of recent legislation will be one requiring the use of water-meters on hydraulic elevators, in factories and business places.

SOUTH FRAMINGHAM, MASS.—The Citizens' Association held a meeting on May 23 to take action regarding the sewerage of Framingham, which is to come before the Legislature. The meeting endorsed the scheme and appointed a committee to further the work. Further information obtainable of Clifton Folger, H. M. Sawyer, or B. T. Thompson.

SAUGUS, MASS.—The citizens held a town meeting on the 23d inst., and voted to adopt a proposition made to them by Lynn for a water-supply. The town will lay its own pipes and the Water Committee has been instructed to make estimates.

TORONTO, ONT.—The City Council has appropriated $5,000 for the purpose of reporting on a gravitation scheme. The Mayor is in favor of settling upon a system of water-supply for the city before a decision is made in regard to the trunk-sewer system. The matter is now being investigated and information may be obtained of Alan Macdougall, City Engineer, or Alderman Carlyle.

WATERTOWN, DAK.—The City Council has located five miles of water-mains to be laid immediately.

BOSTON, MASS.—The Aldermen have authorized loans amounting to $275,000, for the extension of water-mains and other improvements. The Superintendent of Sewers asks for $487,000 for improvements and extension of the city sewerage system.

EAST BRIDGEWATER, MASS.—This town has been considering the question of a water-supply for some time and has now voted to take water from the Bridgewater Company for a term of thirty years. Material will be wanted for the extension.

AMSTERDAM, N. Y.—Bids were opened here for labor on sewers on 25th inst., from twelve contractors and from nine contractors for material.

CANISTEO, N. Y.—The Board of Trustees has prepared a conditional contract, and is ready to receive bids for a complete gravity system of water-works. Proposals will be received until June 4.

GAS, STEAM, BUILDINGS, ETC.

FERGUS FALLS, MINN.—The Fergus Brush Electric-Light Company has been reorganized by James Compton, Frederick G. Barrows and Charles L. Lewis, who have been granted by the City Council an exclusive franchise for thirty years. The lines are to be in operation by October 31, a dynamo engine of 130,000-candle power to be in use.

GRAND RIVERS, TENN.—A town with mines, natural-gas, etc., will be developed here. The president of the company is John G. Houston, of Nashville.

POTTSVILLE, PA.—The opening of bids for lighting the streets has been postponed until June 7.

DETROIT.—The contract for constructing the Detroit Museum of Art has been awarded to Dawson & Anderson, Toledo, O., for $43,000. There was but one other complete bid received, that being from Dean Bros., of this city, at $57,000. The works will be commenced at once. W. D. Balfour, of Hamilton, Ont., is the architect.

GAS-WORKS will be built at Union City, Tenn; A. J. Hoopdale is interested.

WINSTON, N. C.—The Winston Electric-Light and Motive Power Company was incorporated March 25, 1887; capital, $30,000; organized March 30, 1887. D. H. Starbuck is president.

INCORPORATED at Springfield, Ill., are the Belmont Loan and Building Company, of Lake View, George P. Knowles and others. The Chicago Electric Club, to build a club-house; Charles J. Van De Poele and others.

LAWRENCE, MASS., Gas-Light Company will erect an electric-light plant.

LOS ANGELES, CAL.—The County Court-house plans of Cutlet & Eisen were adopted by the Board of Supervisors of Los Angeles County; cost of structure, $350,000.

COLUMBUS, MISS.—The Columbus Gas-Works were purchased May 17 by Mr. J. R. Ryan for $23,500.

COLUMBUS, O.—The Columbus Edison Electric-Light Co. has organized with the following gentlemen as Board of Directors: Charles H. Lindenberg, Emil Kiesewetter, J. R. McLaughlin, F. E. Drake, Jacob Bleile, John Seibert, C. T. Pfaff, Adolph Theobold, and John F. Martin.

MILWAUKEE.—A new steam-heating apparatus will be put in the Tenth Ward School at a cost of $5,000.

HELENA, MONT.—Esler, Lysinger & Co. have been granted a franchise to construct works and maintain a system of arc and incondescent electric-lights in the city.

INCORPORATED is the Illinois Natural-Gas and Fuel Company, of Chicago.

SCOTTSVILLE, KY., will have oil and natural-gaswells sunk by capitalists from Bowling Green and Nashville.

TYLER, TEX.—Col. S. W. Fordyce is applying for a franchise to build gas-works.

CENTRAL FALLS, R. I.—The Pawtucket, R. I., Gas Company has contracted with the Fire District Committee for Central Falls to furnish gas, for $18.75 per lamp. The district will maintain about 125 gas and oil lamps.

COLDWATER, MICH.—Competitive plans are desired for a court-house here. For details see our "Proposal columns."

CINCINNATI, O.—The contracts for Gasoline lamps has been awarded to the Ohio Street-Lighting Company, at $18.71 per lamp per year.

PARKERSBURG, W. VA.—C. H. Shattuck, cashier of the Citizens' National Bank, may be addressed in regard to a new Natural-Gas Company.

NEW YORK.—The Department of Public Works, 3 Chambers Street, is advertising for bids, until June 7, for trap-block and granite-block paving.

RAILROADS, BRIDGES, CANALS.

RAILROAD.—The Minneapolis Terminal Railway Company has filed articles of incorporation. The capital of the company is placed at $1,000,000, and the incorporators are Calvin L. Goodrich, Charles F. Hatch, L. A. Harris, Henry C. Truesdale, and Charles D. Hammond. The object is to construct a belt railway around the city.

INCORPORATED is the Bozeman and Butte Short-Line Railroad Company. Bozeman is the principal office.

RAILROAD.—The Chippewa Falls and Ashland Railway Company has filed articles of association with the Secretary of State of Wisconsin, its object being to build a line between the points named, a distance of 130 miles. The capital stock is three million dollars, and the incorporators are ex-Congressman Thad. C. Pound, L. C. Stanley, L. J. Rusk (a son of Governor Rusk), and other prominent citizens of Chippewa Falls.

MOBILE, ALA.—W. M. Duncan, of Nashville, Tenn., acting for New York capitalists, has bought the street-railway system. Much work will be done in improving the roads.

INCORPORATED is the Arcadia and Monrovia Railroad to build a street-railroad three miles long. E. J. Baldwin, E. F. Spence, and others, directors. The principal office will be in Arcadia.

NEW YORK CITY.—It is reported that the New York Underground Railway Company, Edward Lauterbach, President, will soon begin the construction of a tunnel for the road.

LOS ANGELES, CAL.—Bids for paving have been received by the Council of Los Angeles City. The bids of Dobinson & Fairchild on bituminous rock of San Luis Obispo County, at 25 cents per square foot, and those of Sherer, of San Francisco, for granite blocks, at 28 cents per square foot (with sand in interstices only), were favorably considered. Work on Kuhrts Street Bridge has commenced.

The City Surveyor has reported on a sewerage plan for the city.

MUSKEGON, MICH., will put down $50,000 worth of street pavement.

STREET-RAILROAD.—The City Council of Findlay, O., has granted a franchise to build an electric street-railroad to New York parties.

CANAL.—The Chesapeake and Ohio Canal Canal Company is considering the extension of the canal twenty-seven miles west of Cumberland to Westernport.

JAMESTOWN, N. Y.—The Erie Railway Company has closed a contract for two $60,000 iron vessels for Chautauqua Lake.

NEW YORK and Philadelphia newspapers announce that the Pennsylvania Railroad Co. contemplates building two single-track tunnels under the Hudson River, one for incoming and one for outgoing trains. The tunnels will be 16 feet clear in width by 17 feet in height. The estimated cost of the work is $11,000,000.

RAILROAD.—The Franklin Avenue Railroad Company, of Brooklyn, has been incorporated. William A. Wheelock, Henry Day, J. L. Ward, S. D. Rissley, and others directors.

RAILROAD.—W. B. Thomas, of Athens, Geo., will build a railroad from Tullulah Falls, Geo., to Maryville, Tenn.

PLATTSBURG, N. Y.—The Highway Commissioners want bids for an iron bridge.

BRIDGES.—Atlanta Bridge and Axle Company has the contract for the bridges on the A. & C. Railroad; also for two iron bridges on the Rome and Decatur Railroad.

MONTGOMERY, ALA.—Address A. H. Howland about a street-railway to be built here. Materials are wanted.

MADISON, WIS.—The Freeport, Dodgeville and Northern Railway Company has filed articles of association, the object being to construct a line, forty miles long, from a point of junction with the Chicago, Madison, and Northern in the town of Cadiz, Green County, north-westerly to Dodgeville. Its capital stock is $1,000,000. One of the incorporators is Isham C. Randolph, Chief Engineer of the Illinois Central Railroad.

DES MOINES, IOWA.—The Dacotah Construction Company has been incorporated with a capital stock of $100,000, with headquarters at Des Moines. The incorporators are: S. R. Thorne, New York; S. S. Cole and D. C. Brainard, Des Moines. The object of the corporation is the building and equipping of railroads.

ST. LOUIS, ARKANSAS, AND TEXAS RAILROAD COMPANY will build. Address Col. John S. Young, of St. Louis.

RAILROAD.—The Atlanta and Hawkinsville Railroad has been surveyed to Knoxville, Geo. C. H. Harris has charge of the work.

PITTSBURG, PA.—"The Hump" will be cut down. Mr. Bigelow, Commissioner of Highways, estimates the cost at $420,300. The estimate includes $39,000 for water-pipe; $60,000, for various gas-pipes; $62,750 for sewers, and $93,000 for paving. The grade of several streets will be altered by the improvement.

RAILROAD.—It is proposed to extend the Denver, Utah, and Pacific Railroad to Laramie City. President Miller, of Denver, may be addressed.

BIG RAPIDS, MICH.—The State has passed the House bill to authorize the city of Big Rapids to borrow $30,000 for bridge purposes.

MINNEAPOLIS, KAN.—An exchange says: The Minneapolis, Lincoln & South-western road is a settled fact, and there is no doubt about a road being built from Concordia to Minneapolis and on south through Pawnee Gap to Salina.

INCORPORATED.—The Duluth Short-Line Railway Company, of St. Paul, Minn., has filed articles of incorporation. The capital stock is $600,000. The incorporators are, Phillip S. Harris, William H. Coleman, Jonathan G. Callahan, David A. McKinlay, and George F. Copeland, all of St. Paul. Articles were also filed by the Chicago, Milwaukee and St. Paul Railway Company, for an extension of its line from Albany to New Glarus.

ST. PAUL.—Work on the excavation for the cable-car line has begun. Five hundred tons of rails are now en route. Surveys have been made and locations of water and sewer tunnels taken. Concrete instead of sheeting will be used in the conduit to obviate the whizzing sound of the cable. The rail to be used is known as the "Providence."

EL PASO, TEX.—A stock company is contemplated by Robert S. Towne, George Baggs and others to build a two-span iron bridge across the Rio Grande, near the Southern Pacific Railroad bridge, at El Paso.

LANCASTER, PA.—Work begun on 30 additional blocks of street-railway extension.

MILWAUKEE.—The Milwaukee and Wauwatosa Railroad Company has filed articles of incorporation, with a capital stock of $100,000. The company intends to build a line of street-cars from the corner of Wells and Thirty-fourth Streets to the village of Wauwatosa. It is uncertain whether the cars will be propelled by horse-power or cables.

Robert Nunnemacher and others want a franchise to build a cable line from Juneau Place to the western city limits.

F. E. Hinkly & Co., of Chicago, also want a franchise to build a cable road from the North-western Depot to the west end of Vliet Street.

The St. Paul Railway want to build a line across Fowler Street and the matter is before the Council.

ST. PAUL.—Articles of incorporation of the Metropolitan and Suburban Railroad Company have been filed for record with the Secretary of State. The incorporators are: Maurice Auerbach, Albert Scheffer, L. H. Maxe field, George L. Beardsley, Paul Martin, and Joseph J. McCardy, all of St. Paul. The principal place of business is the city of St. Paul; the amount of capital stock $1,000,000. The company will operate in this county.

FORT MADISON, IA.—The Santa Fe Railroad Company have located their main construction and repair shops here, and will construct a round-house, to cover over fifty acres of ground, at a cost of $2,000,000.

MILWAUKEE.—The Milwaukee and Wauwatosa Railway Company was organized May 12, with a capital stock of $100,000. It proposes to build a street-railway from the city limits to Wauwatosa. The stockholders are, S. C. West, B. G. Schley, R. C. Reinertsen, T. S. Ramsey, Joseph H. Wood, A. B. Meyers, G. W. Ogden, T. B. Mercein, J. W. McWhorter, and John McCullum.

T. E. Hinckley and Co. ask for a franchise to construct a cable line street-railway in Michigan Street, Broadway, Wells, Sixth and Vliet Streets.

OAKLAND, CAL.—There is a movement here for the construction of a park. It is proposed to submit the question of bonding the city to a general election.

MISCELLANEOUS.

BINGHAMTON, N. Y.—The Binghamton Electric Street-Railway was operated for the first time May 23. The road is four miles long, and is a change from the horse-railway. The cost of the change is put at $20,000.

INCORPORATED at Topeka, Kan., is the Kansas and Missouri Land and Investment Company, of Kansas City, Mo. Thomas A. Scott, J. B. Scroggs, and McIntyre Armstrong, of Kansas City, Kan., and Robert H. Hamilton, and C. F. Stroch, of Kansas City, Mo., directors.

MILWAUKEE.—The Merchants' Association have raised $10,703 as an exposition guarantee fund for 1887, and the building will be opened from September 7 to October 22, 1887. Exhibitors can address J. G J. Campbell, manager, or E. J. Becker, secretary.

WINONA, MINN.—Architect C. G. Maybury, of this city, has been instructed to prepare plans and specifications for new court-house, to cost $100 000.

WILMINGTON, DEL.—The directors of the City Passenger Railway Company have unanimously decided to use electricity as a motive power for propelling their street-cars. The idea of using horse-power in the new extension has been given up. Fifty tons of rails are wanted. The committee appointed to consider the adoption of an electric-light system is now at work. Edwin W. Heald may be addressed.

MINNEAPOLIS.—The Minneapolis Steel-Works have organized, and a plant will be put in; capital, $250,000; will employ 250 men. The plant includes two large steel furnaces, a blooming mill, and a merchant mill. J. M. Sullivan, T. H. McCarty, and J. S. Warnock are interested, all of Minneapolis.

BIDS OPENED.

GLOUCESTER CITY, N. J.—Abstract of bids for water-pipe, castings, valves, etc., opened by the Committee on Extensions, April 30: Reeves & West, Gloucester City, $4,752.63; James E. Smith, Gloucester City, $5,335.31. The contract has been awarded to Reeves & West.

ASBURY PARK, N. J.—The following bids for a pumping-engine of 500,000 gallons capacity in 24 hours were received by the Water Commissioners May 14: Holly Manufacturing Company, Lockport, N. Y., $1,700; the Dean Steam-Pump Company, Holyoke, Mass., $1,525. The contract was awarded to the Holly Manufacturing Company, they being the lowest bidder under the terms of the specifications.

COUNCIL BLUFFS, IA.—Bids for the construction of the Broadway and Farnam Street Bridge across the Missouri, were opened May 2. There were thirteen bidders representing the principal bridge-building firms of the United States. Bids ranged from $402,000 to $435,000; the former by the Edgemore Bridge Co., of Wilmington, Del., and it will probably be the one accepted. The specifications require the work to commence in ten days from acceptance and the bridge completed within one year. It will be a wagon and street-car structure.

NEW ALBANY, IND.—The Water-Works Company has awarded the contract for furnishing the twenty-inch mains to be laid from the reservoir along the entire length of Spring Street, to Dennis Long & Co., of Louisville. The pipes will cost about $35,000.

MINNEAPOLIS.—Bids have been accepted on various school buildings by the Board of Education, as follows: For wood-work, H. F. Selden, $23,957; iron-work, Herzog Iron Company, $1,541; foundations of Prescott additions, B. Aronson, $1,025; mill work, Prescott, Minneapolis Sash and Door Company, $480; cut stone for Everett, Thomas Hastings, $1,570.

ALBANY, N. Y.—The following bids for dredging in the Hudson River were received by James Shanahan, Superintendent of Public Works, May 23: E. M. Payn, Albany, 44⅞ cents per cubic yard; P. W. Myers, Albany, 41 3/10c.; John Brown, Mohawk, 32⅛c. Lamont Sanford, Buffalo, 29⅞c. Contract awarded to Lamont Sanford.

NEW YORK.—Bids were open at the Department of Docks, on Friday, May 20, for preparing and building a dumping board and approach at East Eightieth Street, East River. The following were the bidders:

Walter Danforth, New York, $2,395; O'Connell & Coffey, Brooklyn, $2,750; John D. Walsh, Brooklyn, $2,973; Fearon & Jenks, New York, $4,500.

On account of an irregularity in the estimate of the lowest bidder the estimate was referred to the Counsel of the Corporation for his opinion.

GOVERNMENT WORK.

DETROIT, MICH.—Abstract of bids received by Major Mansfield for metal-work for the Pipe Island Light-House, opened May 21: The Russel Wheel and Foundry Co., Detroit, $1,178; Phœnix Iron Company, Trenton, N. J., $1,500; The Colwell Iron Works, New York, $1,700; H. A. Ramsey & Son, Baltimore, Md., $1,895.

ABSTRACT of proposals received and opened May 20, 1887, by Major Thomas H. Handbury, Corps of Engineers, U. S. A., for furnishing iron and steel for lock-gates and filling valves for La Grange Lock, Illinois River:

Williams, White & Co., Moline, Ill., steel, per pound, 5.4 cents; wrought-iron, per pound, 3.9 cents; cast-iron, per pound, 4.8 cents.

Builders' Iron Foundry, Providence, R. I., 6.87, 5.45, and 5.45 cents, respectively.

Vierling, McDowell & Co., Chicago, Ill., 6½, 9, and 6¼ cents, respectively.

BIDS opened by the Supervising Architect, May 14, for a silver-storage vault, North Court, Treasury Building, at Washington, D. C., excavating, concreting, and masonry; synopsis of bids: Daniel E. Driscoll, $18,918; McCarthy & Corbett, $18,427; A. L. Phillips, $18,896.13; Frank Baldwin, $17,127; M. A. McGowan, $16,990; William Rothwell, $15,466.

CLEVELAND, O.—The following bids for repairs at Port Clinton Harbor, Ohio, were received by Major L. Cooper Overman, U. S. Engineers, May 23: John Stang, Lorain, O., white oak, per M feet, B. M., $39; piles, per lin. foot, 35c.; filling stone, per cord, $5.50; rip-rap, per cord, $5.50; brush, per cord, $3.50; drift-bolts, per lb., 3c.; spike, per lb., 4c.; S. & W. bolts, per lb., 4c.; total, $1,905.79. Only bid received.

DETROIT, MICH.—Abstract of proposals for adapting the present north and west range lights in Sandusky Bay, O., to the use of gasoline as an illuminant, received and opened at the office of U. S. Light-house Engineer, Tenth District, Detroit, Mich., at 3 P. M. of Monday, the 23d day of May, 1887, under advertisement of May 9, 1887: Russel Wheel and Foundry Company, Detroit, Mich., metal and carpenter work and gas-machines, $3,144.

SYNOPSIS of bids for drain-pipe, opened May 20, 1887, by Supervising Architect Treasury Department, for Post-Office, etc., Baltimore, Md.: Henry McShane & Co., Baltimore, Md., $1,988.94; Crook, Horner & Co., Baltimore, Md., $2,243.13.

SYNOPSIS of bids for iron-work Post-Office., etc., Lexington, Ky.: Motherwell Iron and Steel Company, Logan, O., $4,895; Marshall Foundry and Construction Company, Pittsburg, Pa., $4,037.67; Dearborn Foundry Company, Chicago, Ill., $4,226; Clark, Raffin & Co., Chicago, Ill., $3,934; Fred Myers Manufacturing Company, Covington, Ky., $3,218.

SYNOPSIS of bids opened by Commander Harmony of Bureau Yards and Docks, Navy Department, for iron floating-gate or caisson, at Navy Yard, Boston, Mass.: Atlantic Works, East Boston, Mass., $37,800. This bid is $6,800 in excess of appropriation.

SYNOPSIS of bids opened by Secretary of the Navy, for wharf and hospital, at Widow's Island, Me.: Wharf—Francis Hitchcock, Rockland, Me., $2,185; John H. O'Rooke, Brooklyn, N. Y., $2,200. Hospital—John H. O'Rooke, $46,922; William H. Glover, Rockland, $35,490.

SYNOPSIS of bids for broken stone and Portland cement flooring for building for State, War and Navy Departments, Washington, D. C., opened by Col. Casey:

For Portland cement flooring, H. L. Cranford, Washington, D. C., 13½c. per square foot; Geo. Drew, Washington, D. C., 14.9c. per square foot; Schilinger Artificial Stone Co., Washington, D. C., 12c. per square foot; broken stone, 275 yards (more or less), Barber Asphalt Pav. Co., Washington, D. C., $2 per cubic yard; Hugh Waters, Washington, D. C., $1.85 per cubic yard; Natural Hydraulic Cement (800 pounds), Jas. M. Wheatly, Washington, D. C., $1.12 per pound; J. G. and J. M. Waters, Washington, D. C., $1.12 per pound.

ABSTRACT of proposals for gas-fixtures and gilt rods for building for State, War and Navy Departments, Washington, D. C., opened by Col. Casey:

The Joseph Newman Co., Philadelphia, Pa., gilt rods, $1,230.38; Cornelius & Hetherington, Philadelphia, Pa., gas-fixtures, $12,662,80; gilt rods, $1,407.37; Mitchell, Vance & Co., New York, gas-fixtures, $14,533.40; Schultz Gas Fixtures and Art Metal Co., Baltimore, Md., gas-fixtures, $12,326.15.

TOO LATE FOR CLASSIFICATION.

SYRACUSE, N. Y.—The Syracuse Gas-Light Co. has increased its capital stock to $500,000 for the purpose of building a new gas-holder, tank, and purifiers and also extending the mains.

MERRILL, WIS.—A water-works company have filed a $10,000 bond for the faithful performance of its contract to construct works for the city of Merrill.

FLORENCE, WIS.—The city has decided to own the water-works, and will purchase the plant.

BENTON, MONT., is still unsettled in regard to the subject of water-works.

BRISTOL, VT.—The Bristol Manufacturing Company contemplates putting in water-works for its own use and will want material.

CAMDEN, N. J.—The Pavonia Water-Works are to be enlarged. The city will advertise for a new pump of 10,000,000 gallons capacity per day.

MACON, GEO.—This city is considering the enlargement of its water-supply about three millions of gallons per day, by using adjacent springs. About $15,000 will be spent.